

Trouble-shooting instructions: AUD-5002

BOSCH system : EI-K

Vehicle make : Audi

Basic microcard : PKW-051

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SPECIAL FEATURES

These brief instructions apply to the
Audi model valid at the time of writing:
Audi 100,
Engine 2,3 l, 5 cyl. 100 kW
Code letter NF.
Year of manufacture 1986.

*EI-K control unit 0 227 400 113,..134

*Ignition coil with trigger box 0 221 600
050

*Ignition coil without trigger box 0 221 122
358

*Self-diagnosis (flash code)

*Variant encoding (not wired)

STRUCTURE, USE

These brief instructions essentially contain
vehicle-specific special features and
set values.

In accordance with the customer complaint,
the trouble-shooting chart points to various
causes/component defects.

Detailed instructions on trouble-shooting
should be taken from the basic instructions
via the trouble-shooting chart.

NOTE: Even when referring to basic
instructions, the set values, terminal
assignments, and special features of
t h e s e vehicle-specific brief
instructions are a l w a y s binding.

Keep people away from danger.
Prevent damage to the engine, trigger box
and control unit, or ignition system.

High-performance ignition system.
Dangerous high and low voltages.

Do not touch voltage-carrying parts or terminals; risk of fatal injury on primary and secondary sides.

***Before carrying out compression testing, remove the control-unit plug or connect ignition coil term. 4 firmly to ground with auxiliary cable.**

N o t e : The auxiliary cable must be interference-suppressed to min. 2 k Ω .

For further precautionary measures see the basic instructions.

Customer complaint (symptoms of trouble)

1. Starting motor operates, engine fails to start or starts only with difficulty
2. Engine starts but then dies
3. Idle problems (engine speed, exhaust)
4. Poor throttle response.
5. Engine missing (ignition, injection)
6. Insufficient maximum power/speed
7. Excessive fuel consumption
8. Engine diesels
9. Engine pings/knocks
10. Engine overheats
11. Fault lamp.

										Cause (component fault)
*	*	*	*	*	*	*	*	*	*	Self-diagnosis
*				*						High-voltage side
*				*						Ignition coil
*										Firing sequence
*										Voltage - EI-K control unit
*										Ignition-distributor plug and socket
*										Voltage, magnetic pulse generator
*										Function, magnetic pulse generator
*										EI-K control units, function
*										Voltage, trigger box
*										Primary signal
*										Triggering, electric fuel pump relay

TROUBLE-SHOOTING CHART (continued)
Customer complaint (symptoms of trouble)

TROUBLE-SHOOTING CHART (continued)
Customer complaint (symptoms of trouble)

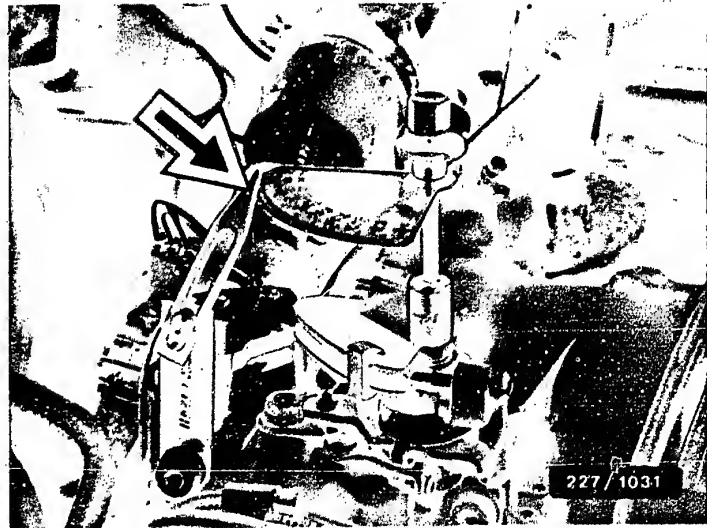
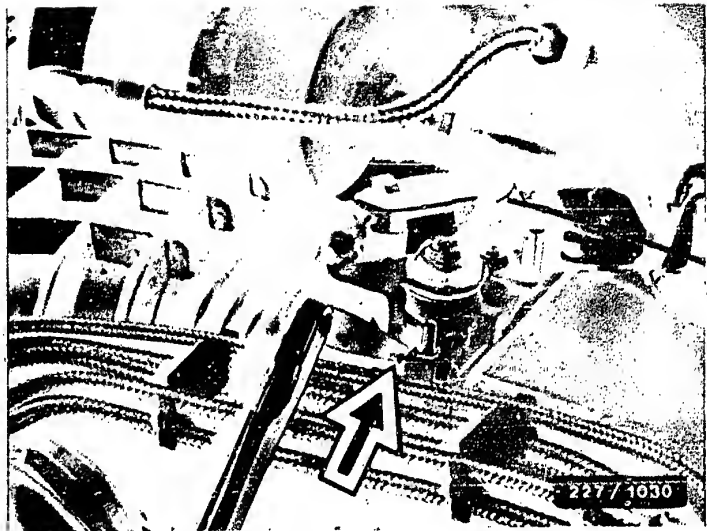
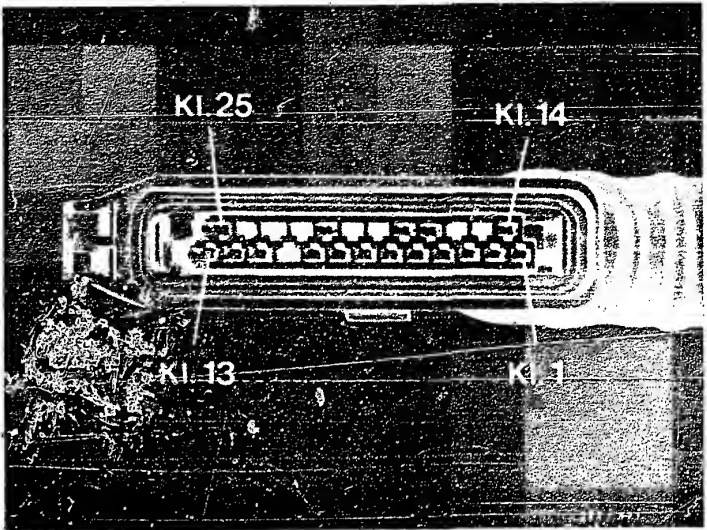
1. Starting motor operates, engine fails to start or starts with difficulty.
2. Engine starts but then dies.
3. Idle problems (engine speed, exhaust).
4. Poor throttle response.
5. Engine missing (Ignition, injection).
6. Insufficient maximum power/speed.
7. Excessive fuel consumption.
8. Engine diesels.
9. Engine pings/knocks.
10. Engine overheats.
11. Fault lamp.

[illegible]

For production reasons:
continued on the following
coordinate.

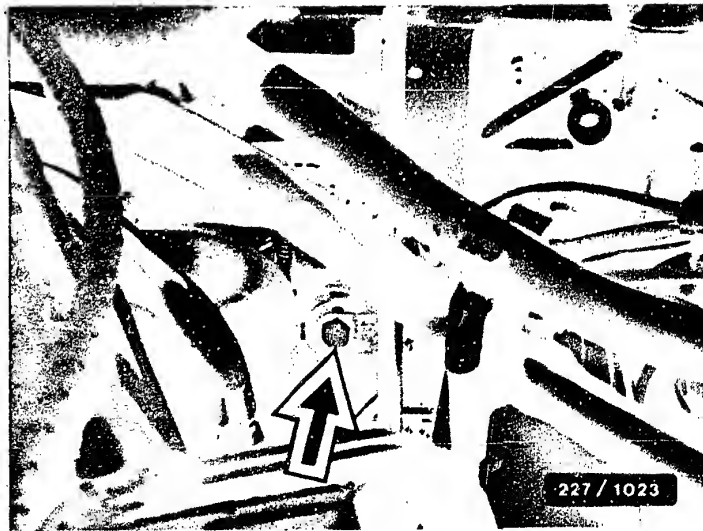
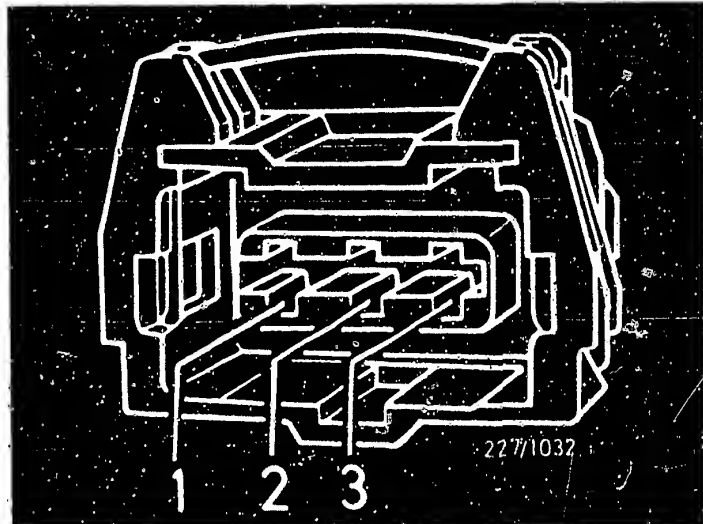
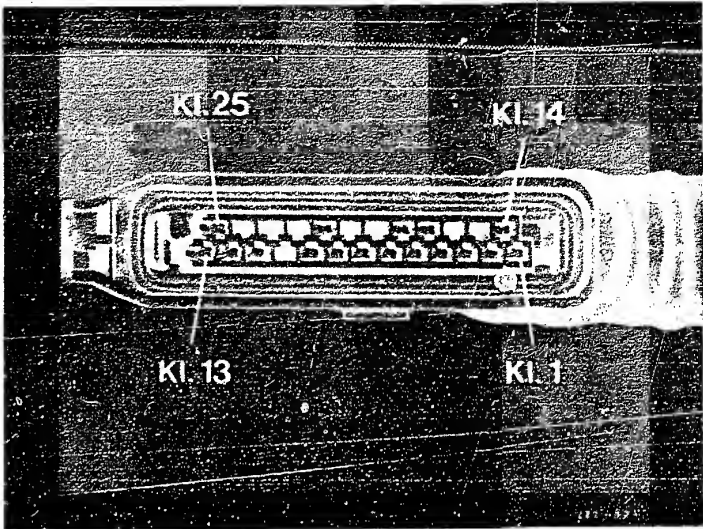
SELF-DIAGNOSIS TEST TABLE

Fault display Flash code	Testing of component/function Test instructions/conditions	Term.	Set values
1 1 1 1	EI-K CONTROL UNIT Replace EI-K control unit.	—	—
2 1 2 1	THROTTLE-VALVE SWITCH - IDLE Voltage, EI-K control-unit plug. Upper illustration. Throttle valve in idle position. Ignition ON. Feeler gauge 0,5...0,7 mm between throttle-valve stop and adjusting screw. See center illustration, arrow.	7 20 (+) (-)	approx. battery voltage 0 V
2 1 2 3	THROTTLE-VALVE SWITCH - FULL LOAD Voltage, EI-K control-unit plug. Throttle valve in idle position. Ignition ON. Graduated disc on throttle valve level 1. See lower illustration, arrow. 68...76° after idle position.	9 20 (+) (-)	0 V approx. battery voltage.



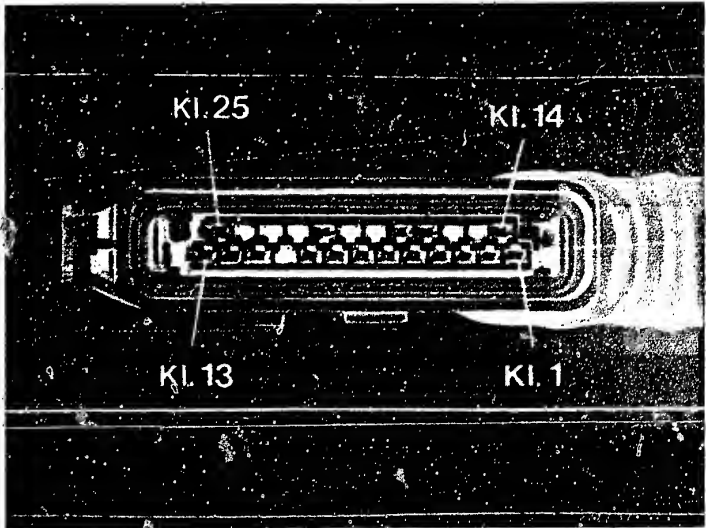
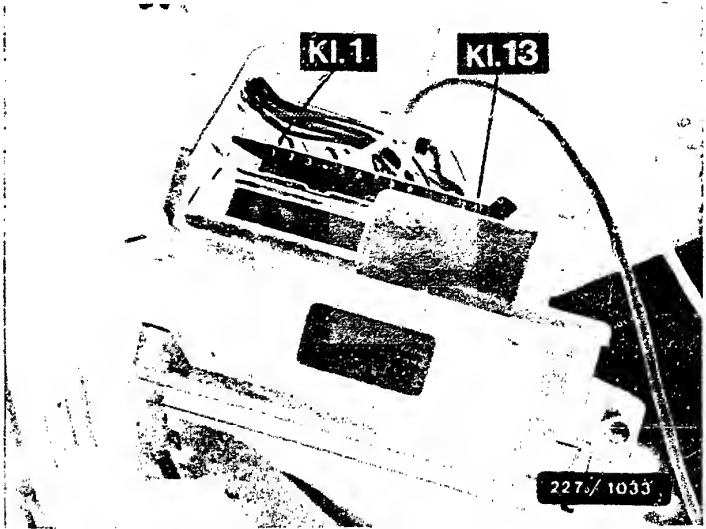
SELF-DIAGNOSIS TEST TABLE (Continued)

Fault display Flash code	Testing of component/function Test instructions/conditions	Term.	Set values
2 1 4 1	MAXIMUM RETARDATION OF KNOCK CONTROL Fuel with insufficient octane number, Check ignition-point adjustment, fuel- injection. Bearing damage, abnormal engine noises.	—	—
2 1 4 2	KNOCK SENSOR Resistance of EI-K control-unit plug (upper illustration) and knock-sensor plug connection (center illustration). Resistance of knock-sensor plug connec. See center illustration. Tightening torque. See lower ill., arrow.	13 1 12 2 12 3 1 2	approx. 0 Ω approx. 0 Ω approx. 0 Ω infinite Ω 15-25 Nm
2 2 2 3	ALTITUDE SENSOR Voltage of EI-K control-unit plug. See upper illustration. Ignition ON.	2 20 (+) (-)	Sea level = 3,2-4,7V 500 m = 2,8-4,0V 1000m = 2,4-3,5V 1500m = 2,0-3,0V 2000m = 1,5-2,5V 3000m = 0,8-1,6V



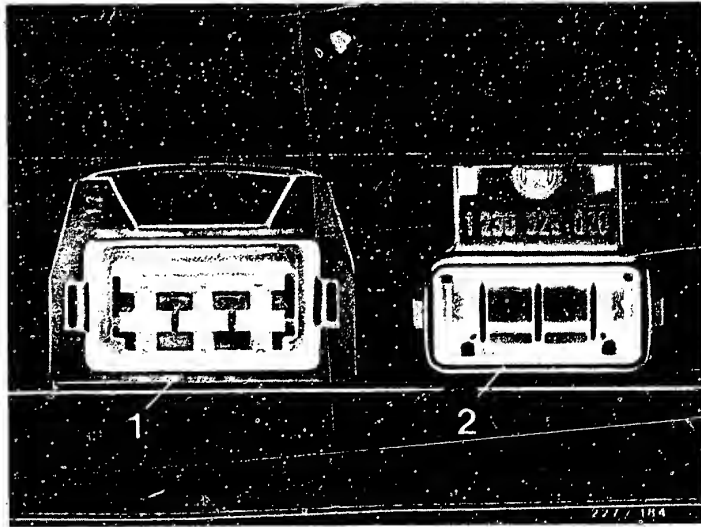
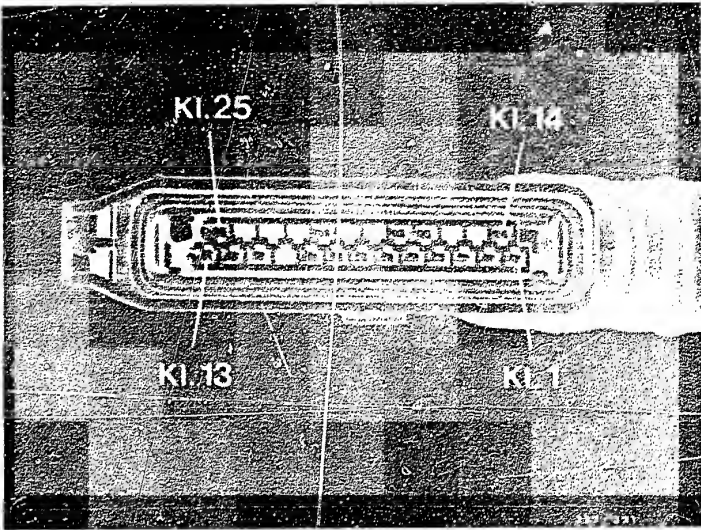
SELF-DIAGNOSIS TEST TABLE (Continued)

Fault display Flash code	Testing of component/function Test instructions/conditions	Term.	Set values
2 2 3 2	LOAD SIGNAL Voltage, EI-K control-unit plug with handle cover removed. See upper illustration. Engine at idle.	8 20 (+) (-)	0,2-4,6 V
2 2 3 3	REFERENCE VOLTAGE FOR LOAD- AND ALTITUDE-SENSOR SIGNAL Voltage, EI-K control-unit plug. See lower illustration. Ignition ON.	21 20 (+) (-)	4,5-5,1 V
2 3 1 2	TEMPERATURE SENSOR - COOLANT Resistance of EI-K control-unit plug. See lower illustration.	25 20	+ 20°C=2,1-2,9k Ω + 30°C=1,4-2,0k Ω + 80°C=280-370 Ω + 90°C=210-280 Ω +100°C=160-210 Ω
4 4 4 4	NO FAULT IN MEMORY	—	—
0 0 0 0	END OF FAULT OUTPUT	—	—



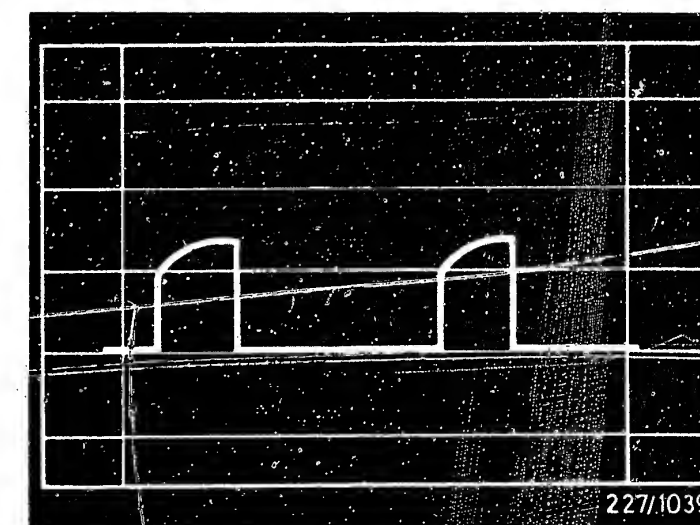
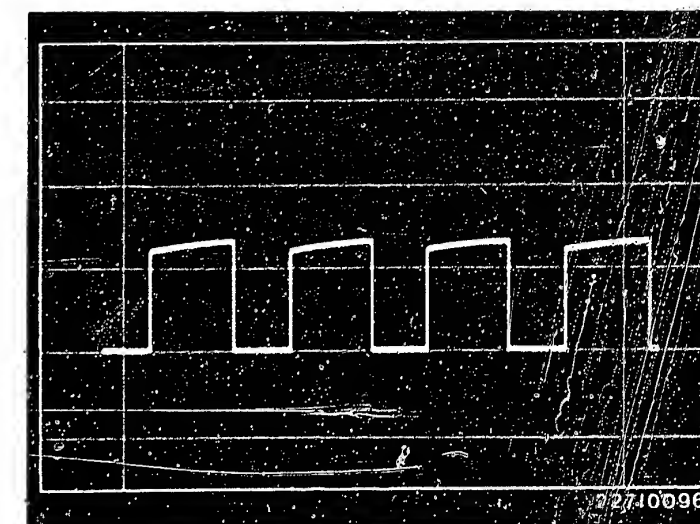
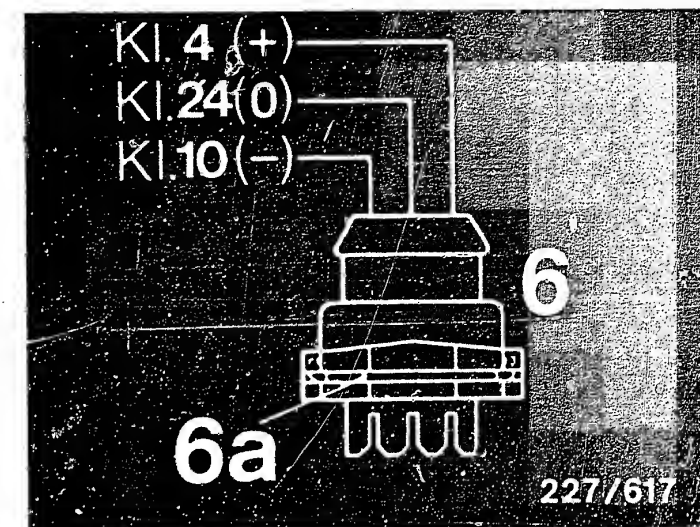
RAPID DIAGNOSIS CHART

Test step	Testing of component/function Test instructions/conditions	Term.	Set values
1	HIGH-VOLTAGE SIDE For example, check spark plugs, ignition harness, distributor cap, etc. for proper operation (e.g. open circuits, shunt). Evaluate with ignition oscillogram, resistance measurement, visual check for example.	—	—
2	IGNITION COIL Visual check (Bosch only): Are seal plugs present, has sealing compound escaped? Primary resistance (Bosch) Secondary resistance (non-Bosch) Primary resistance (Bosch) Secondary resistance (non-Bosch)	— 1 15 1 15 1 4 1 4	— 0,6–1,0 Ω 0,5–1,5 Ω 6,4–11,1 k Ω 5,0–9,0 k Ω
3	VOLTAGE SUPPLY, EI-K CONTROL UNIT Disconnect EI-K control-unit plug. Ignition ON. Voltage of EI-K control-unit plug. See upper illustration.	6 20 (+) (–)	Battery voltage
4	IGNITION-DISTRIBUTOR PLUG AND SOCKET Disconnect ignition-distributor plug. Visual check: Check ignition-distributor plug and socket for oxidation. See lower illustration.	—	—



RAPID DIAGNOSIS CHART (continued)

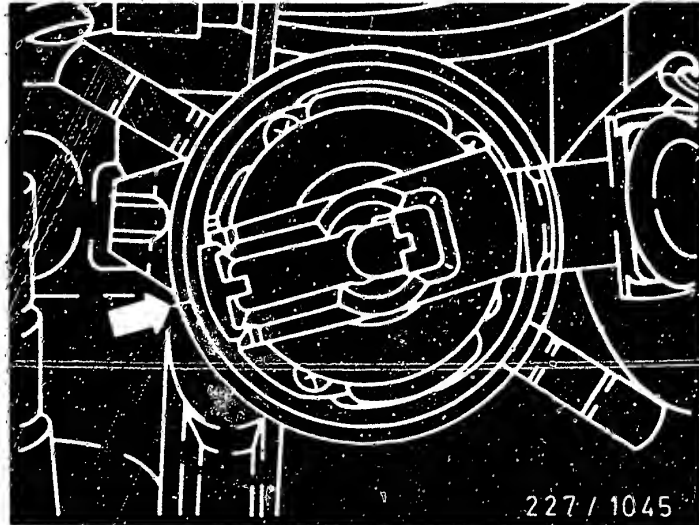
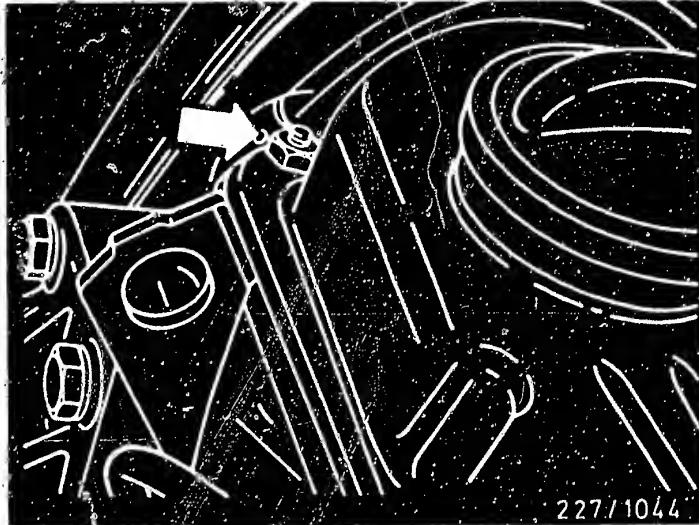
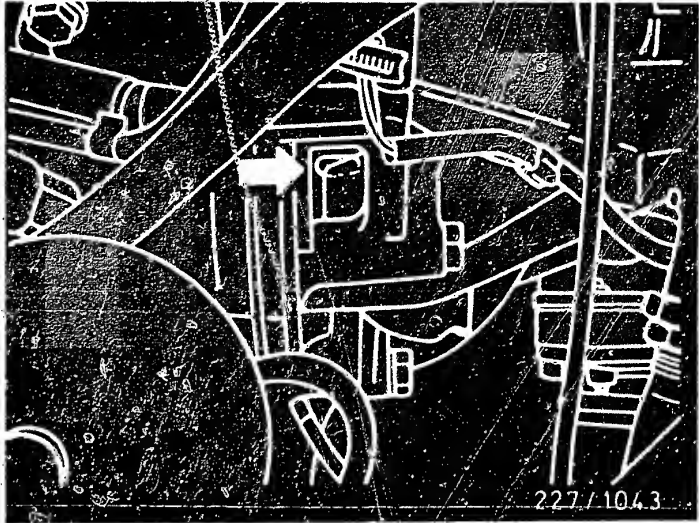
Test step	Testing of component/function Test instructions/conditions	Term.	Set values
5	VOLTAGE SUPPLY, MAGNETIC PULSE GENERATOR Connect ignition distributor and EI-K control-unit plugs. Ignition ON. Voltage, ignition-distributor plug. See upper illustration.	4 10 (+) (-)	equals/above 10 V
6	MAGNETIC PULSE GENERATOR - FUNCTION Start engine. "Special" oscilloscope to ig.-distributor plug. See upper illustration.	24 B- (+) (-)	Rectang. pulse (centre illus.)
7	EI-K CONTROL-UNIT - FUNCTION Trigger-box, ignition-distributor, and EI-K control-unit plugs connected. Start engine. "Special" oscilloscope to trigger-box plug.	2 B- (+) (-)	Rectang. pulse (lower illus.)
8	VOLTAGE SUPPLY, TRIGGER BOX Disconnect trigger-box plug. Ignition ON. Voltage, trigger-box plug.	1 3 (+) (-)	Battery voltage



RAPID DIAGNOSIS CHART (Continued)

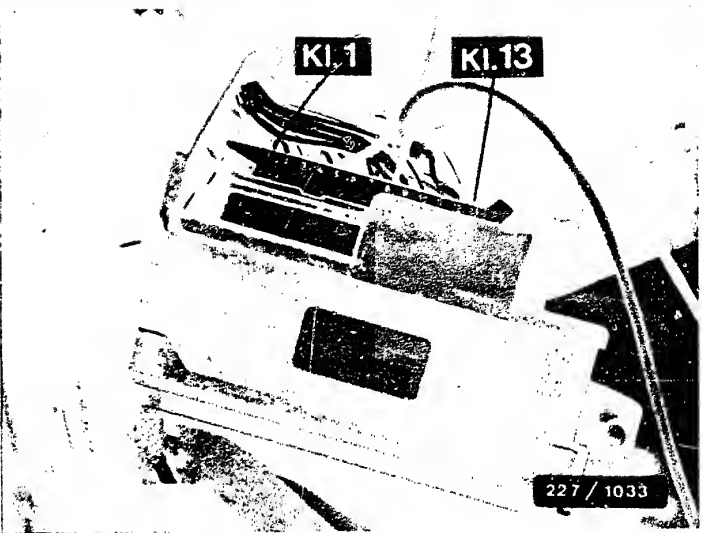
Test step	Testing of component/function Test instructions/conditions	Term.	Set values
9	PRIMARY SIGNAL EI-K control-unit, trigger-box, and ignition-distributor plugs connected. Start engine. Oscilloscope/engine-speed tester to ign. coil.	15 1 (+) (-)	Primary voltage - engine-speed display (level unimportant)
10	TRIGGERING, ELECTRIC FUEL PUMP RELAY Ignition ON. The electric fuel pump relay including the electric fuel pump are triggered (can be heard).	—	Triggering approx. 1 second
11*	CONTACT RESISTANCES Check trigger-box voltage supply leads or primary circuit for contact resistance.	various	max.0,5 Ω
12*	IGNITION-DISTRIBUTOR INSTALLATION SETTING Engine cyl. 1 at TDC. Upper illustration. Camshaft marking aligns with upper edge of valve-cover seal. Center illustration. Middle of distributor rotor points to housing marking. Lower illustration.	—	—
13	FAULT LAMP Ignition ON. Engine at idle.	— —	Fault lamp lights up Fault lamp OFF

* carry out only when engine not running.



RAPID DIAGNOSIS CHART (Continued)

Test step	Testing of component/function Test instructions/conditions	Term.	Set values
14	BASIC IGNITION SETTING Engine-oil temperature at least 80° C Throttle valve in idle position. Air conditioner switched off. Fault lamp must not be flashing. Bridge contacts on electric fuel pump relay with fuse. Engine at idle. Note: Setting 15±1° before TDC	—	13 - 17° before TDC
15	VOLTAGE SUPPLY, EI-K CONTROL UNIT Voltage at EI-K control-unit plug with handle cover off. Upper illustration. Engine at idle.	6 20 (+) (-)	12 - 14 V max. 2 V below V _B
16	VOLTAGE SUPPLY, IGNITION COIL Engine at idle. Voltage of ignition coil and battery.	15 B- (+) (-)	equals/above 10 V



TEST SPECIFICATIONS

Throttle-valve switch Idle with ignition ON in idle position	Approx. battery voltage
Feeler gauge 0,5 – 0,7 mm between throttle-valve stop	0 V
Throttle-valve switch – full-load Idle position	0 V
Open throttle valve 68...76° with ignition ON	Approx. battery voltage
Knock sensor Tightening torque	15...25 Nm
Altitude sensor Sea level	3,2 – 4,7 V
500 m	2,8 – 4,0 V
1000 m	2,4 – 3,5 V
1500 m	2,0 – 3,0 V
2000 m	1,5 – 2,5 V
3000 m	0,8 – 1,6 V
Load signal with engine idling	0,2 – 4,6 V

TEST SPECIFICATIONS (Continued)

Reference voltage for load and altitude sensors with ignition ON	4,5 – 5,1 V
Temperature sensor – coolant	+20°C 2,1 – 2,9k Ω +30°C 1,4 – 2,0k Ω +80°C 280 – 370 Ω +90°C 210 – 280 Ω +100°C 160 – 210 Ω
Ignition coil primary (Bosch)	0,6 – 1,0 Ω
primary (non-Bosch)	0,5 – 1,5 Ω
secondary (Bosch)	6,4 – 11,1 k Ω
secondary (non-Bosch)	5,0 – 9,0 k Ω
Voltage supply, EI-K control unit with ignition ON	Battery voltage
Voltage supply, magnet pulse generator with ignition ON	Equals/above 10 V
Magnet pulse generator functioning at cranking speed	Rectangular pulse

TEST SPECIFICATIONS (continued)

EI-K control unit functioning at cranking speed	Rectangular pulse
Voltage supply, trigger box with ignition ON	Battery voltage
Primary signal at cranking speed	Primary voltage/ engine-speed display
Triggering of electric fuel pump relay with ignition ON	Approx. 1 second (acoustic)
Contact resistance	max. 0,5 Ω
Supply leads, trigger box or primary circuit	
Ignition-distributor installation setting	Cyl. 1 at TDC Igtn.-dist. marking
Fault lamp Ignition ON with engine idling	ON OFF

TEST SPECIFICATIONS (continued)

Basic ignition setting	13 - 17° before TDC
Electrical fuel pump relay bridged Engine idling	(Setting value 15±1°)
Voltage supply, EI-K control unit Engine idling	12 - 14 V max. 2 V below battery voltage
Voltage supply, ignition coil Engine idling	equals/above 10 V

For setting values for idle speed, exhaust,
valve play, etc. see the Jetronic SIS
microcard or Autodata test specifications.



High-voltage arrows: Danger 400 V...25 kV

A1= Trigger box
A2= KE-Jetronic control unit
B1= Magnetic pulse generator
B2= Knock sensor
B3= Temperature sensor - coolant
B4= Air-flow sensor (Pot.)
B5= Altitude sensor

E1= To ignition distributor
H1= Fault lamp
K1= Electric fuel pump relay
P1= Contacts for diagnosis
S1= Throttle-valve switch
idle/full load

T1= Ignition coil
X1= EI-K control-unit plug
X2= Encoding plug
Y1= Electric fuel pump

INSTALLATION POSITION OF COMPONENTS

The EI-K control unit is located in the footwell on the driver's side.

The altitude sensor is located in the driver's side footwell above the EI-K control unit.

The KE-Jetronic control unit is located in the passenger-side footwell.

Variant encoding unit is located in the footwell on the passenger's side in a plastic case near the KE-Jetronic control unit.

The coolant temperature sensor is located near the spark plug of cyl. 1

The idle/full-load throttle-valve switch is located on the throttle-valve assembly.

The trigger box and ignition coil are located near the windshield-washer fluid container.

The knock sensor is located near the left engine mounting.

The electric fuel pump relay is located in the central electrics box.

The fault lamp is located on the instrument panel.

For production reasons:
continued on the following
coordinate.

TABLE OF CONTENTS

Trouble-shooting instructions : CIT - 5000

BOSCH system : L3.1 - Jetronic

Vehicle make : Citroen

Basic microcard : PKW - 044

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SPECIAL FEATURES

These brief instructions apply to the following vehicle models with 1.9l/4 cyl. engine valid at the time of writing:

Citroen BX 19 GTi EU 07.86->

*L3.1-Jetronic with 15-pin control units:
0 280 000 601, with automatic transmission
0 280 000 609. Triggered by term. 1 of ignition coil.

*Electric fuel pump control by control unit via pump relay.

*Control unit supply voltage via main relay

*To check fuel pressure use pressure gauge and hose lines of pressure testing device KDJE-P 100.

Connect 3-way line KDJE-P 100/13 between the fuel supply line and the pressure damper.

STRUCTURE, USAGE

These brief instructions essentially cover the vehicle-specific special features and test specifications (set values).

Corresponding to the customer complaint, the trouble-shooting chart leads to various causes/component faults.

Detailed instructions for trouble-shooting must be taken from the basic instructions via the trouble-shooting chart.

NOTE: Even if reference is made to basic instructions, the set values, terminal assignments and special features in these vehicle-related brief instructions are always binding.

The numbering of the test steps is the same for both the brief and basic instructions in order to make it easier to find individual test steps.

SAFETY AND PRECAUTIONARY MEASURES

Keep people out of danger.

Avoid damage to the engine, control unit or ignition system.

* C A U T I O N !

High-performance ignition system.
Dangerous high and low voltages.

Do not come into contact with parts or terminals which carry voltage; danger, primary and secondary sides.

* Avoid injection when testing the compression.
Therefore, disconnect the double relay.

See basic instructions for further precautionary measures.

TROUBLE-SHOOTING CHART

Customer complaint (symptom of trouble)

1. Starting motor operates, but engine fails to start or starts with difficulty.
2. Engine starts but then dies.
3. Rough idling (Speed, exhaust).
4. Poor throttle response, poor progression.
5. Engine misfiring (Ignition, injection).
6. Engine lacks power/maximum speed not obtained.
7. Fuel consumption too high.
8. Engine diesels.
9. Engine pings/knocks.
10. Engine overheats.
11. Fault lamp.

										Cause (component fault)
*	*	*	*	*	*	*	*		*	Universal test adapter
*	*	*	*		*					Air intake system
*	*	*	*							Auxiliary-air device
*		*	*	*	*	*				Air-flow sensor
				*	*					Quantity of fuel
*	*	*	*		*	*	*			Fuel pressure, leakage
		*								Pump noises
		*		*	*	*	*			Solenoid-operated injection valves
				*						Generator, interference suppression
*	*	*				*				Starting control
				*		*				Overrun cut-off
		*	*	*		*				Engine-speed adjustment, CO adjustment

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01
 Adapter cable: 1 684 463 168

Test step	Switch		Terms.	Inspection of component/function	Test instructions/conditions	Set values
	V	Ω				
1	I V	5	8 - 5	Resistance, temperature sensor (engine)	Connect only control-unit plug Engine temperature +15...+30 °C; approx. +80 °C;	1.45...3.3 k Ω 280...360 Ω
2	I V	6	4 - 5	Ground connection of output stage		0...10 Ω
3	-	-	-	Not applicable		
4	I V	9	15 - 5	Resistance of idle contact	Throttle valve closed: Throttle valve open :	0...10 Ω Infinite Ω
5	I V	10	14 - 5	Resistance of full-load contact	Throttle valve closed : Throttle valve fully open:	Infinite Ω 0...10 Ω
6	5	10	1 - 5 (+) (-)	Term: 1 - signal from ignition coil term. 1	Transmission in neutral, start	Ignition pulses on oscilloscope
7	6	10	2 - 5 (+) (-)	Control-unit voltage supply	Switch on ignition	8...15 V
8	7	10	12 - 5 (+) (-)	Winding of pump relay	Switch on ignition	8...15 V

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (continued)
 Adapter cable: 1 684 463 168

Test step	Switch V	Ω	Terms.	Inspection of component/function	Test instructions/ conditions	Set values
9	7	10	12 - 5	Simulation of control of electric fuel pump	Disconnect lead plug from auxiliary-air device Switch on ignition Press test key 3	Electric fuel pump running (check by listening)
9.1	7	10	12 - 5	Simulation of control of auxiliary air device	Connect lead plug to auxiliary-air device Switch on ignition Press test key 3	Aperture closes air cross- section, visual check
10	7	10	12 - 5 (+) (-)	Ground triggering of pump relay term. 2 by control unit	Connect control unit with adapter cable. Transmission in neutral. Let engine idle.	0...5 V
11	8	10	11 - 5 (+) (-)	Air-flow signal UP output term. 11	Let engine run	0...5 V Depends on load
12	-	-	-	Not applicable		
13	10	10	3 - 5 (+) (-)	Injection pulses from control unit	Let engine run	Injection pulses on oscilloscope
14	11	10	10 - 5 (+) (-)	Load signal TL output term. 10	Let engine run	TL rectangular pulses, depends on load
15	12	10	9 - 5 (+) (-)	Reference voltage UV output term. 9	Let engine run	3.5...4.5 V
16	10	10	3 - 5 (+) (-)	Simulation Engine cold	Let engine run, press test key 1	Injection pulse wider, or engine speed lower

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (continued)
 Adapter: 1 684 463 168

Test step	Switch		Terms.	Inspection of component/function	Test instructions/conditions	Set values
	V	Ω				
17	10	10	3 - 5 (+) (-)	Simulation Engine warm	Let engine run, press test key 2	Injection pulse must not get wider
18	10	10	3 - 5 (+) (-)	Simulation Overrun cut-off	Let engine run, engine speed over 2000 min -1 Press test key 5	No injection pulses, engine surges
19	10	10	3 - 5 (+) (-)	Simulation Full-load correction	Let engine run, engine speed approx. 2400 min -1 Press test key 6	Slight change in injection pulses or engine speed.

TEST SPECIFICATIONS

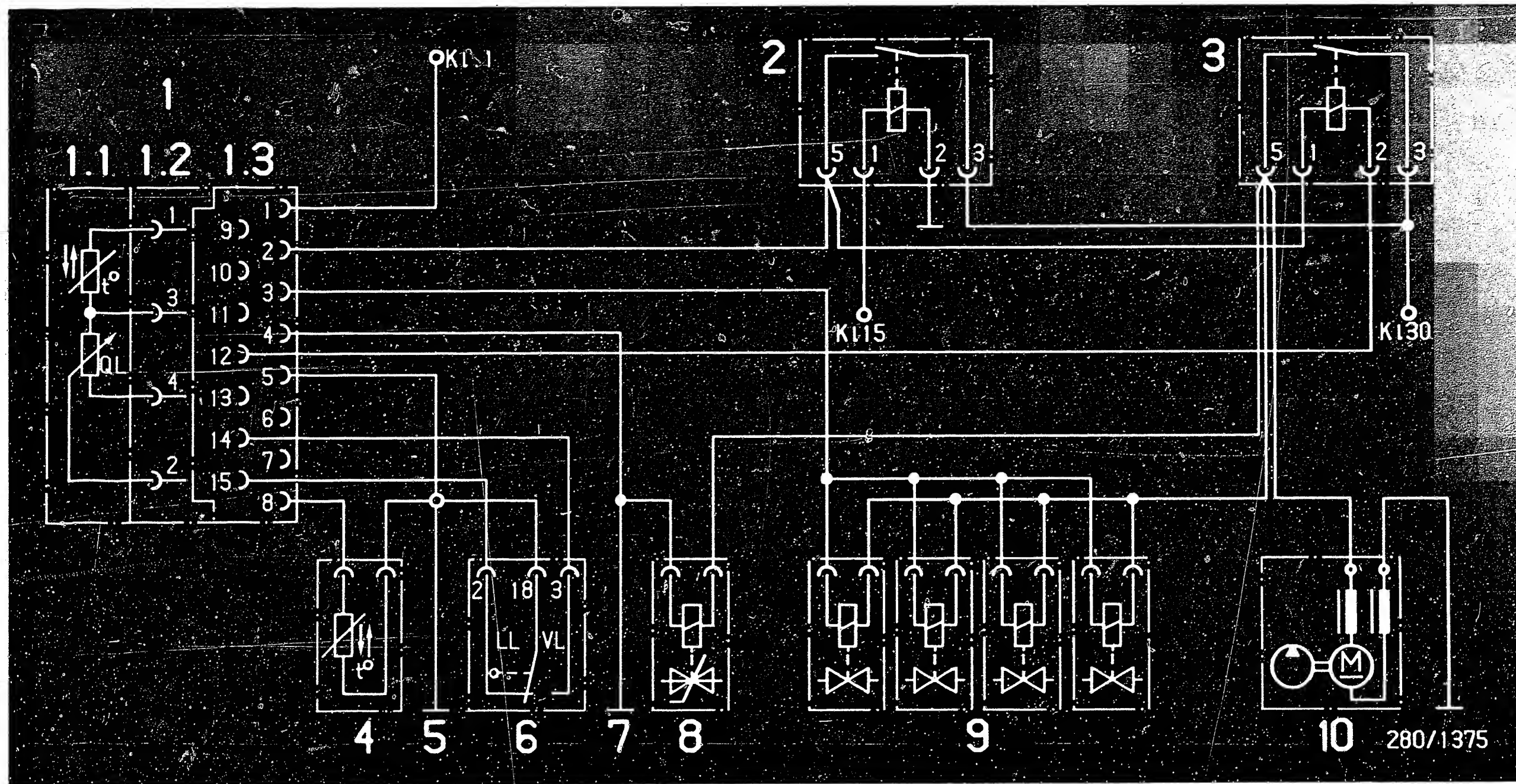
Component/function	Set values
Electric fuel pump	
* Delivery quantity in return:	at least 700 cm ³ /30s
* Connection voltage under load:	at least 12V
Pressure regulator	
* Fuel pressure	
With engine stationary:	2.3...2.7 bar
In idle:	approx. 0.5 bar less
Fuel system, sealing	
* Fuel pressure after engine stationary 20 min.:	at least 1.0 bar
Auxiliary-air device	
* Electrical internal resistance:	35...70 Ω
Air-flow sensor, can only be measured when control unit has been removed.	
* Resistance between	
Term. 3- and term. 4-:	500...1000 Ω
Term. 3- and term. 2-:	
Sensor flap in rest position	10...200 Ω
Reading must change when sensor flap deflects.	
Temperature sensor (air), can only be measured when control unit has been removed.	
* Electrical internal resistance between terms. 3- and 1- , at ambient temperature +15...+30 °C :	1.45...3.3 k Ω

Component/function

Set values

Temperature sensor (engine)	
* Electrical internal resistance at ambient temperature +15...+30 °C :	1.45...3.3 k Ω
With engine at operating temperature, approx. +80 °C :	280...360 Ω
Solenoid-operated fuel-injection valve	
* Electrical internal resistance at ambient temperature +15...+30 °C :	14.5...17.0 Ω
* Sealing after 60 s :	No drops must fall
Start control	
* Connection voltage at solenoid-operated fuel-injection valve	
Beginning of starting:	approx. 1.5 V
After approx. 15s:	approx. 0.5 V
Overrun cut-off	
* Resumption speed	
+15°...+30°C:	approx. 1600 min -1
approx. +80°C:	approx. 1300 min -1
Idle adjustment	
Engine at operating temperature, approx. +80 °C	
* Idle speed:	850...950 min -1
* CO-content:	1.5...2.5 Vol %

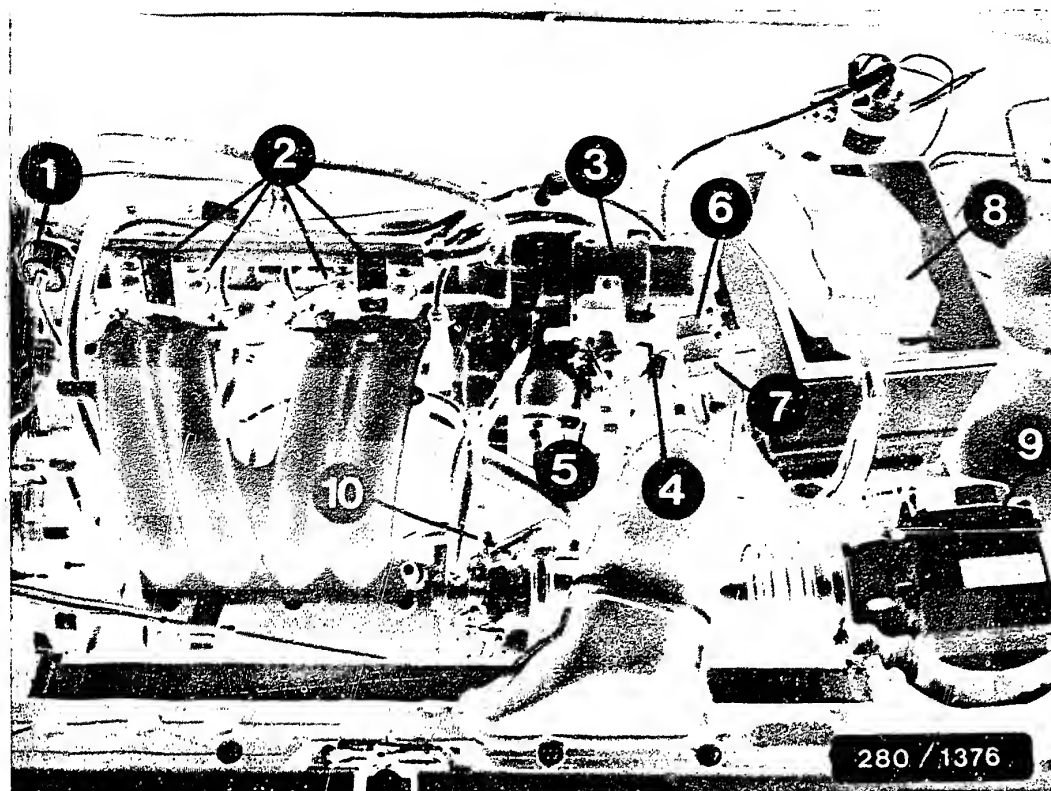
For adjustment values for ignition, valve play, and other technical engine data, see the equipment and Autodata microcard.



ELECTRICAL TERMINAL DIAGRAM

1 = Measurement and control unit
 1.1 = Air-flow sensor
 1.2 = Control unit
 1.3 = Control-unit plug
 2 = Main relay
 3 = Pump relay
 4 = Temperature sensor (engine)

5 = Electronics ground
 6 = Throttle-valve switch
 7 = Ground output stage
 8 = Auxiliary-air device
 9 = Fuel-injection valve
 10 = Electric fuel pump

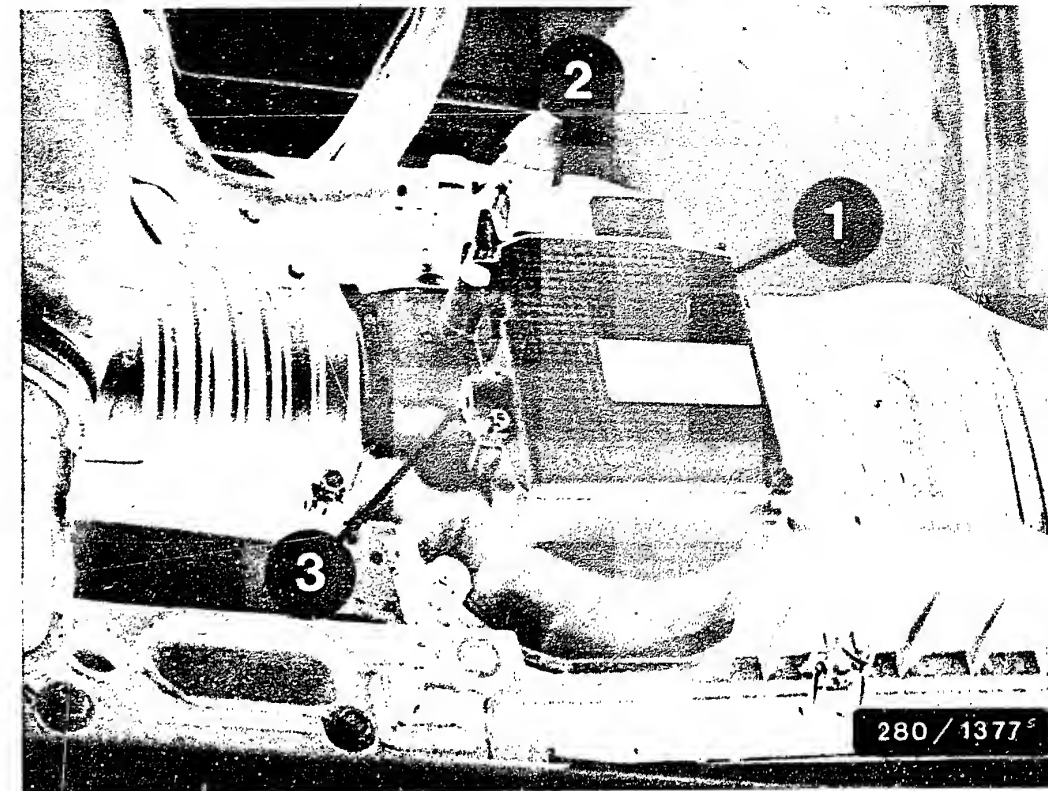


INSTALLATION POSITION OF COMPONENTS

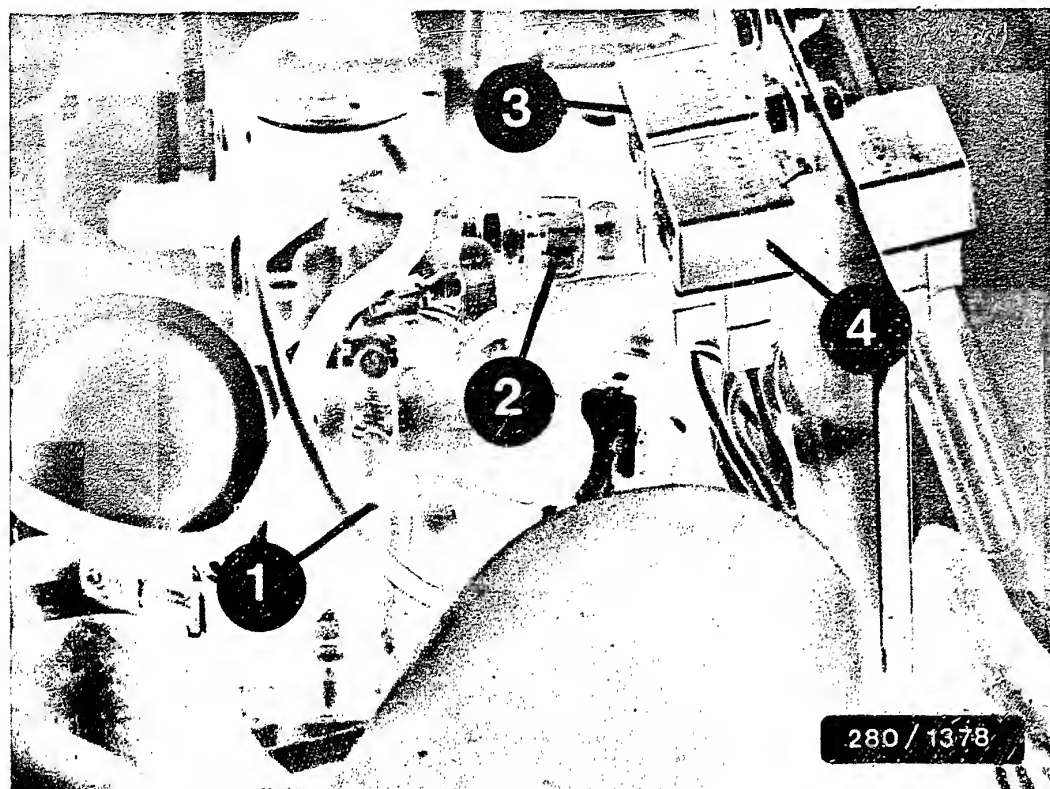
All location specifications are with reference to the direction of travel.

Arrangement of components in engine compartment:

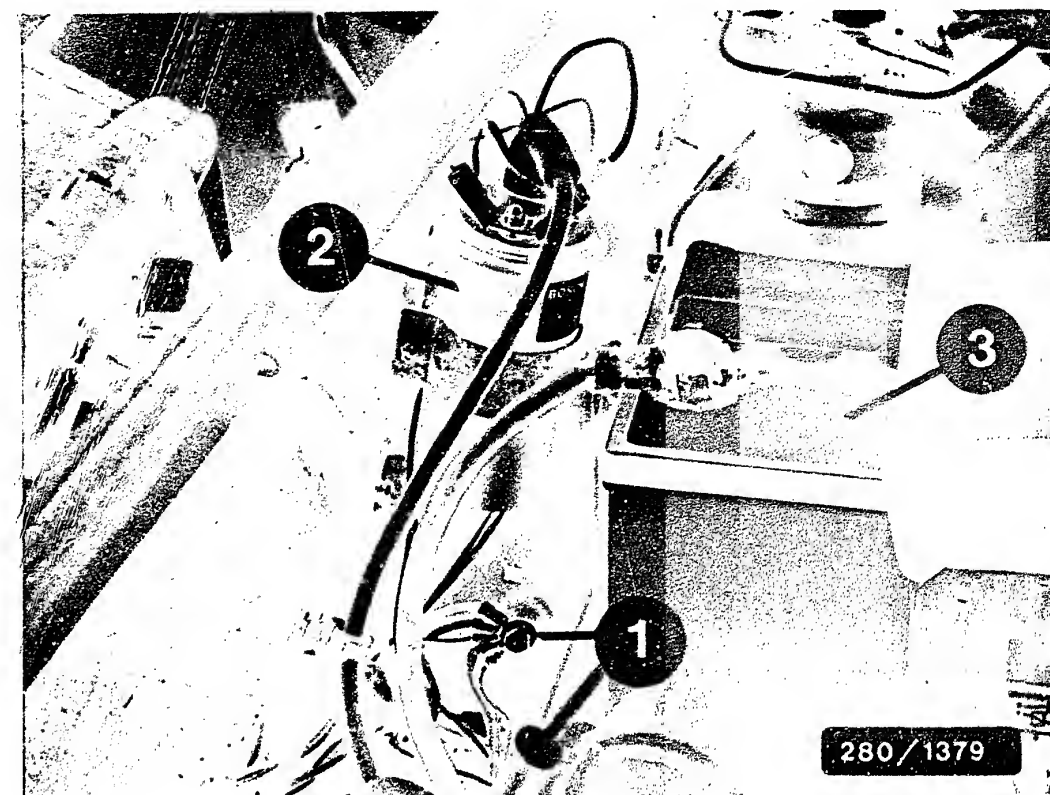
- 1 = Pressure regulator
- 2 = Solenoid-operated fuel-injection valves
- 3 = Ignition distributor
- 4 = To temperature sensor (engine)
- 5 = To auxiliary-air device
- 6 = Pump relay
- 7 = Main relay
- 8 = Relay covering
- 9 = Measurement and control unit
- 10 = To throttle-valve switch



- 1 = Measurement and control unit consisting of air-flow sensor and control unit
- 2 = 15-pin control-unit plug
- 3 = CO-adjustment screw with safety cap



- 1 = Auxiliary-air device
- 2 = Temperature sensor (engine)
- 3 = Pump relay
- 4 = Main relay



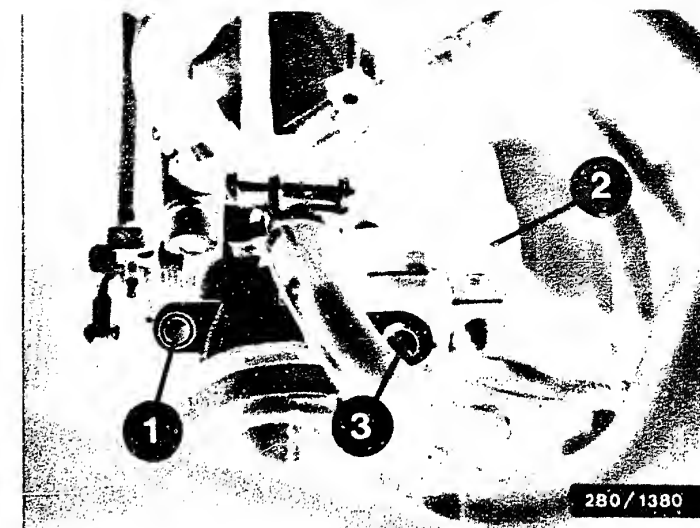
- 1 = Ground connection
- 2 = Ignition coil
- 3 = Battery

Further installation-position information

*The electric fuel pump and fuel filter are fastened to the floor of the vehicle on the right behind the rear axle.

*For testing, e.g. fuel delivery quantity or fuel pressure, the safety circuit must be bridged.

Disconnect pump relay, insert cable bridge between terms. 5 and 3 in the connection socket. The electric fuel pump should run.



- 1 = Throttle-valve stop screw
- 2 = Throttle-valve switch
- 3 = Idle-speed-adj. screw

1 = Jumper with fuse holder and 10 A fuse (user-fabricated)

2 = Top view of connection base

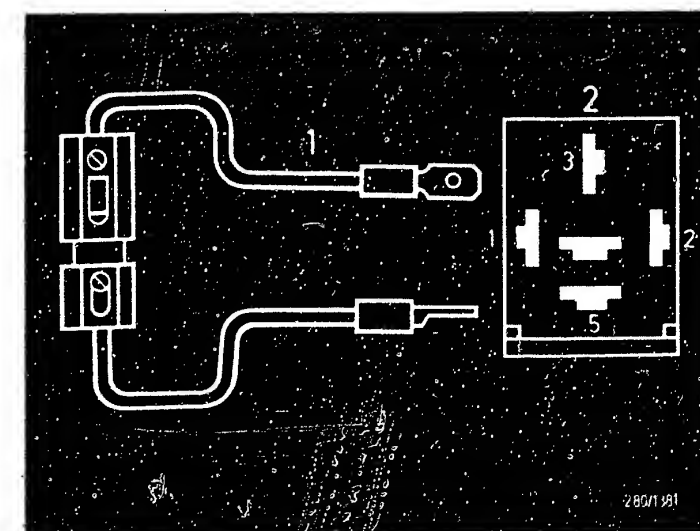


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Trouble-shooting instructions: FZG - 5000

BOSCH system : Vehicle electrics - General

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General

When the electrical system of motor vehicles (e.g. ignition system, generator system) is operating, undesired, high-frequency, electromagnetic waves are generated, which may disrupt the reception of the receiving system installed in the vehicle, as well as the reception of receiving systems in other vehicles or of receivers located further away.

These high-frequency disturbances of reception are known as radio interference. The disruptions may be heard in the loudspeaker of the system in the form of buzzing, clicking, crackling, yawling or howling, and disrupt the useful received signal or render it under certain circumstances useless.

For this reason, suitable means must be sought by which these disturbances can be eliminated or reduced, i.e. the devices and systems (sources of interference) which cause this radio interference must be suppressed.

This is achieved by connecting the sources of interference to suitable means of suppressing radio interference.

Classes of interference suppression

Long-range interference suppression

Long-range interference suppression is statutory for all motor vehicles and is provided by the vehicle manufact. The aim of long-range interference suppression is to avoid transmission of the interference signals generated in the vehicle to transmitting stations and receiving systems.

Short-range interference suppression

Short-range interference suppression is necessary if transmitting stations or receiving systems are to be operated in the vehicle. The demands made on the suppression equipment, and the engineering effort are greater in the case of short-range interference suppression than with long-range interference suppression.

Means of interference suppression

Resistors

Spark-plug connectors, ignition-distributor caps and distributor caps with integrated interference suppression resistors, suppressed spark plugs.

Capacitors and chokes

Shunt, feed-through and by-pass capacitors, chokes and interference-suppression filters.

Shielding

Shielded spark plugs, H.T. ignition cables, and distributor caps.

Ground

Ground straps of metal braiding.

Sources of interference

- 1.Ignition system: sparks at spark plug and distributor cap, contact-breaker sparks with breaker-triggered systems.
- 2.Generator system: howling noises caused by magnetic rotating field and generator regulator.
- 3.Electrical consuming devices: brush arcing of electric motors.
- 4.Switching contact: contact arcing on actuating relays and switches.
- 5.Lead connections: loose contacts in current-carrying conductors, poor ground of antenna, loose contact in H.T. ignition cables.
- 6.Electrostatic charge of: generator V-belt or of transmission components, bowden cables and exhaust systems.

In addition, interference may be caused by poor or alternating metallic contact between metallic components of the vehicle.

Detection of interference, notes on
elimination of interference

Antenna installation

Despite optimum suppression, a residual noise level remains in the immediate vicinity of the source of interference. For this reason, the vehicle antenna must be mounted as far away from the source of interference as possible; the installation instructions for the antenna/of the vehicle manufacturer must be observed in every detail.

Cleaning the antenna

The wanted signal of the retractable-rod antenna is reduced by dirt, i.e. poorer radio reception. Remedy: clean the antenna from time to time using a Bosch antenna cleaning cloth.

Detection of the source of interference

The source of interference may be detected on the basis of the interference noise audible in the loudspeaker.

Ignition interference

Buzzing and crackling dependent upon the engine speed. Run the engine at increased, constant engine speed, then switch off the ignition. Interference noise disappears on switching off the ignition.

Generator interference

Howling and yowling dependent upon the engine speed. Run the engine with increased engine speed, switch on consuming devices, and switch off the ignition. Interference noise can still be heard after switching off the ignition and reduces synchronously as the engine speed drops.

Interference through auxiliary units

Interference in the form of howling and buzzing when an auxiliary unit is switched on (e.g. windshield wipers, fan). Interference disappears on switching off the unit.

Detection of the noise path

Interference via the antenna

For rapid diagnosis, pull the antenna plug out of the antenna socket of the receiver. Interference noises which did reach the receiver via the antenna are now no longer audible.

Interference in leads

Interference which reaches the receiver via the positive or negative leads or the loudspeaker leads is in most cases low-frequency interference which makes its way from the source of interference to the input of the receiver via the vehicle electrical system. To test for this, turn the volume control knob of the unit fully back to the "zero volume" position. (Engine must be running). The interference noise remains audible at the same volume.

Interference via the connection leads of radio components

The same as interference in leads. Interference irradiation e.g. in connection leads between car radio and booster/equalizer or cassette deck. To test for this, turn the volume control knob of the unit fully back to the "zero volume" position (Engine must be running). The interference noise remains audible at the same volume.

USING THE TROUBLE-SHOOTING CHART AND TROUBLE-SHOOTING PROGRAM

The TROUBLE-SHOOTING chart starts on Coordinate 09 and contains customer complaint (fault symptom/characteristic) with several possible causes (component faults) in each case, as well as coordinate references for detailed trouble-shooting. If no coordinate reference is given, it is a matter of a cause which cannot be eliminated by means of interference suppression, such as shading of the received signal or multipath reception.

If the customer complaint has been clearly diagnosed, perform trouble-shooting in the given order of the possible causes, one after the other and step by step.

If the customer complaint has not been clearly diagnosed, check all the causes listed in the trouble-shooting chart. To prevent possible incorrect measurements, check all causes in the order given (because of the interlinking of test steps).

HOW TO USE TROUBLE-SHOOTING CHART AND TROUBLE-SHOOTING PROGRAM (continued)

The TROUBLE-SHOOTING PROGRAM contains all system and component checks mentioned in the trouble-shooting chart. It is divided into three rows of boxes.

The left-hand column contains test instructions and set values.
The center column contains instructions on trouble-shooting and fault rectification.
The right-hand column contains the illustrations/terminal diagrams belonging to the text, with explanations.

If the questions in the left-hand column can be answered conclusively with "yes", continue trouble-shooting with the next box down.

If the answer to the question is "no", branch to the center column and carry out the tests in the order given there.
After rectifying a fault repeat the test as a check.

TROUBLE-SHOOTING CHART

Customer complaint (symptom of trouble)

1. Buzzing and crackling (dependent upon engine speed)
2. High-pitched howling and yowling (dependent upon engine speed)
3. Interference from auxiliary units
4. Buzzing and crackling caused by vibrations
5. Crackling and clicking when ignition switched on
6. Howling and yowling (dependent upon generator load)
7. Heterodyne whistling
8. Strengthening and weakening of received signal
9. Interference caused by obstructions

Cause (component fault)									
		*							Vehicle antenna
		*							Cable connections
*		*							Ignition system
	*			*					Generator system
	*	*		*					Electrical consuming devices
*	*								Secondary source of interference
			*						Electronic systems
*	*			*					Laying of lines
	*			*					Common grounding point
				*					Multipath reception
					*				Fading
					*	*			Shading
					*				Reflection
					*				Lattice-fence effect

NECESSARY TEST EQUIPMENT, AIDS

Motor tester, e.g. MOT 201	0 684 000 201
Multimeter e.g. Fluke 23	comm. avail.
Universal grease Ft 1 V 36	5 700 014 082
Ground-contact scraper	8 697 910 251
Contact protective grease and anti-corrosion grease	6 787 317 207

TROUBLE-SHOOTING PROGRAM (1)

Testing vehicle antenna

Disconnect antenna plug from radio receiver.
Attention! If length of antenna cable > 3.5 m, take shortening capacitor into consideration.

Connect ohmmeter in turn to:

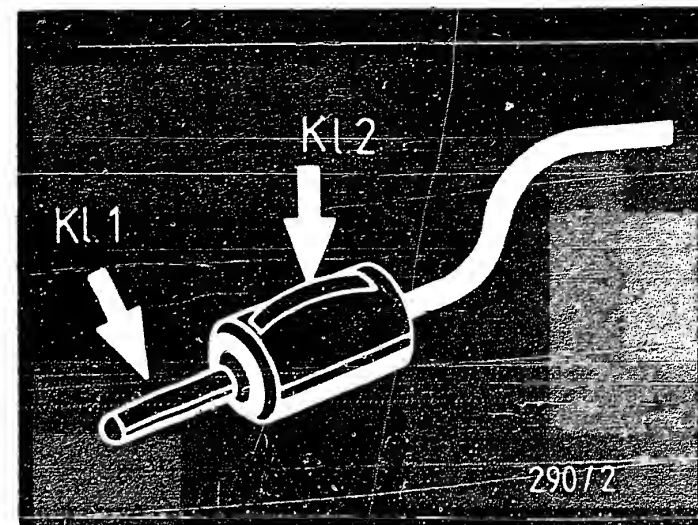
1. Antenna plug term. 1 and term. 2 (insulation).
Set value: > 1 M Ω
2. Antenna plug term. 2 and antenna base (shielding).
Set value: approx. 0 Ω
3. Antenna base and engine block (ground of base).
Set value: approx. 0 Ω .
4. Antenna plug term. 1 and retractable-rod tip (continuity).
Set value: 0 up to max. 3.5 Ω .

Are set values obtained in tests 1 to 4?

N>

Clean vehicle antenna, e.g. using Bosch antenna cleaning cloth.
Disassemble antenna, scrape antenna hole blank using a ground-contact scraper from below and grease with Bosch universal grease.

Repeat measurements as per points 1 - 4.
If set values are not obtained, replace vehicle antenna.



Return to trouble-shooting chart

TROUBLE-SHOOTING PROGRAM (2)

Testing cable connections

Test electrical connections and junctions of the radio components for good connection and contact.

Cable connections OK?

N>

Repair cable connections and/or wiring harness.

Return to trouble-shooting chart

TROUBLE-SHOOTING PROGRAM (3)

Testing interference field,
ignition. (High-voltage side)

N>

Repair high-voltage
side.

Test spark plugs, spark-plug
connectors, interference-
suppression resistors, ignition
cables, distributor cap, distri-
butor rotor etc. for correct
functioning (e.g. open circuit,
shunt).

Assessment e.g. using ignition
oscillogram, resistance measure-
ment and visual check.

Note: electronic ignition
systems must be interference-
suppressed with at least 2 k Ω .
The original distributor rotor
with 1 k Ω must not be
replaced by a 5 k Ω distribu-
tor.

High-voltage side

OK?

Testing interference field,
ignition
(continued)

N>

Tighten ignition-coil connec-
tions, eliminate oxidation.

Test ignition-coil connections
for firm seating and oxidation.
Visual examination OK?

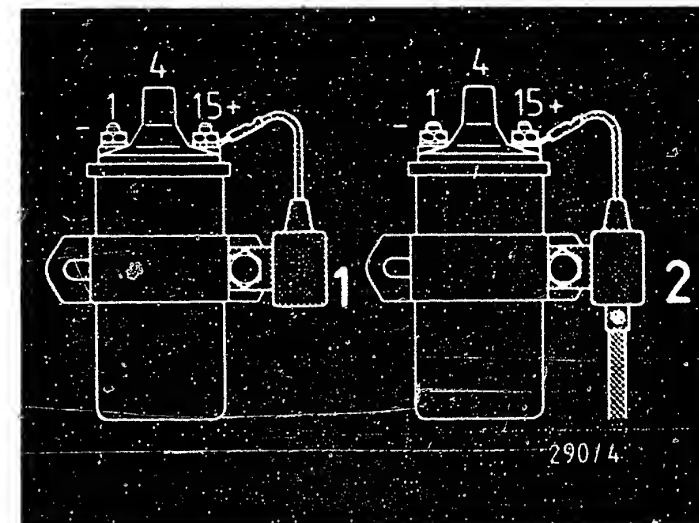
Testing interference field,
ignition (continued)

N>

Apply suitable suppression cap-
acitor to ign. coil term. 15.

Is ignition coil term. 15 con-
nected to suppression capacit.?

Return to trouble-shooting chart



Illus.: short-range interfer.
suppr. of the ign. coil (example)

1 = Suppression capacitor (ign.
coil connected to ground)

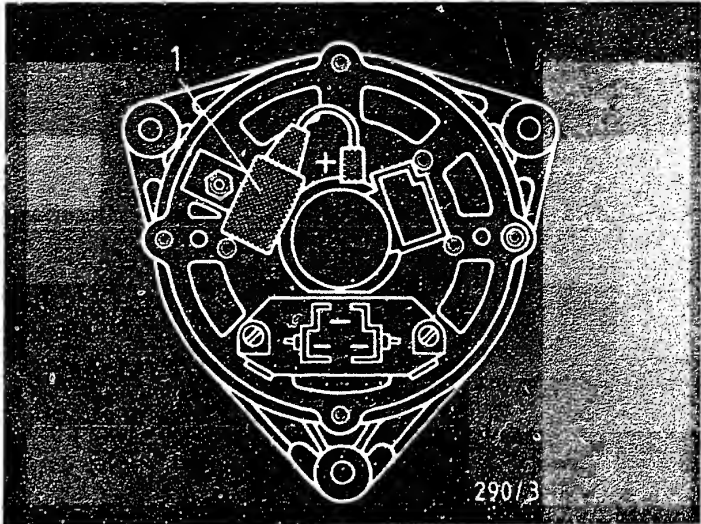
2 = Suppression capacitor and
ground strap (ign. coil not con-
nected to ground).

TROUBLE-SHOOTING PROGRAM (4)

Testing the generator system
Is generator term. B+ connect-
ed to suppression capacitor?

N>

Connect generator to suitable
suppression capacitor.



1 = Suppression capacitor

Return to trouble-shooting chart

TROUBLE-SHOOTING PROGRAM (5)

Electrical consuming devices

Start engine and run at idle.
Switch on radio unit.

Detect source of interference by connecting electrical consuming devices into the circuit.

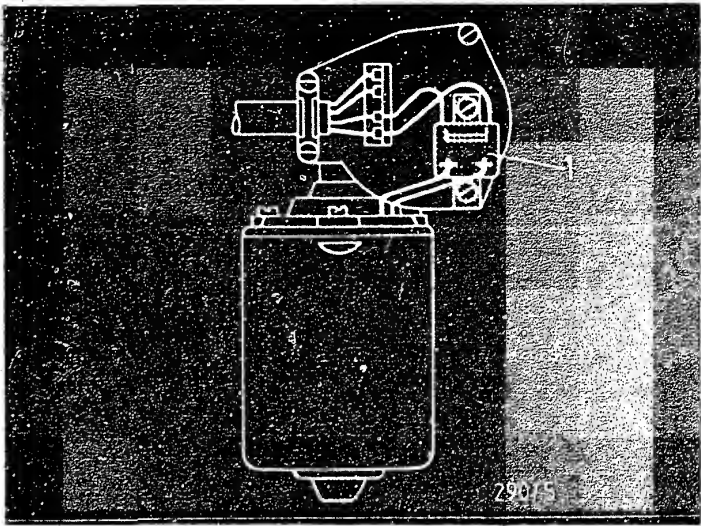
Repeat test at higher engine speed.

Interference noise must not be heard from the loudspeaker.

Test OK?

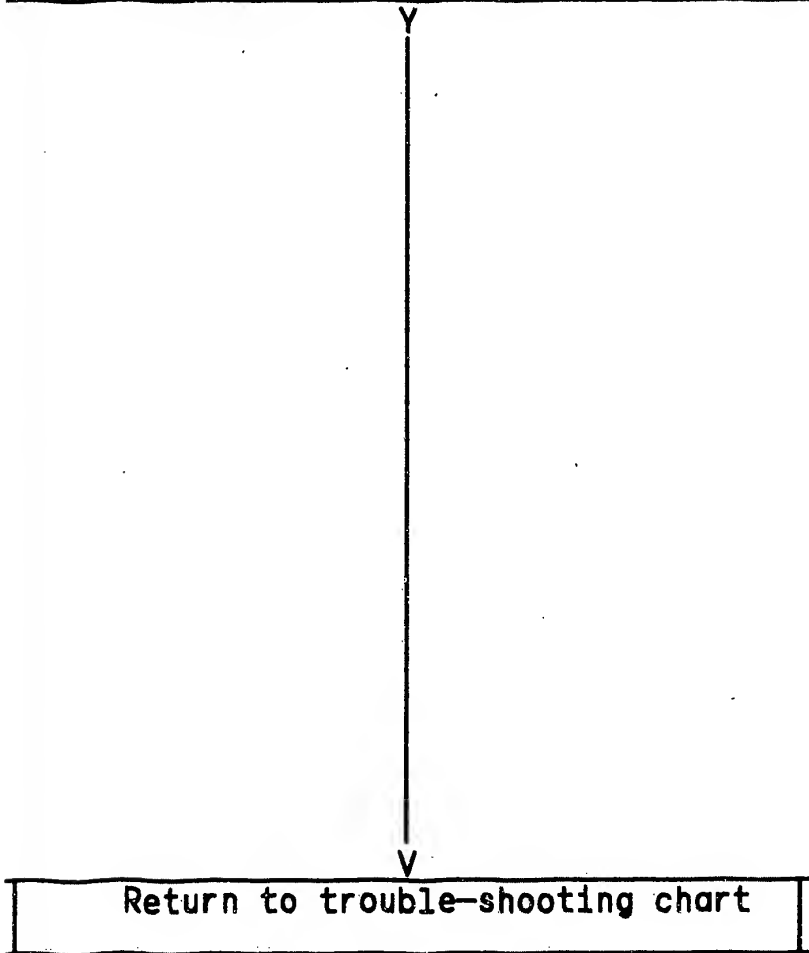
N>

Connect suitable interference-suppression filters such as 0 290 003.., 0 290 002.. to interfering components, or replace defective components.



Illus: short-range interference suppr. of a wiper motor (example).

1 = Interference-suppr. filter



TROUBLE-SHOOTING PROGRAM (6)

V

Secondary source of interference

Lay voltage-supply leads of radio components, antenna leads and loudspeaker leads separately from bowden cables (e.g. of heater control mechanism and engine hood lock).

Laying of leads OK?

N>

Check new laying of leads for sources of interference.

Y

Return to trouble-shooting chart

C21

<==>

C22

<==>

TROUBLE-SHOOTING PROGRAM (7)

↓

Electronic systems

Lay voltage-supply leads of radio receiver, antenna leads and loudspeaker leads separately from e.g. wiring harness of injection system. Lay antenna lead through the footwell, near to the firewall.

N>

Inspect new laying of lines for sources of interference.

Laying of lines OK?

↓

Return to trouble-shooting chart

C23

<==>

C24

<==>

TROUBLE-SHOOTING PROGRAM (8)

Testing laying of lines

Voltage-supply leads for radio components, antenna lead and loudspeaker leads must be laid separately from the vehicle wiring harness.

Installation and laying of leads OK?

N>

Inspect new laying of lines for sources of interference.

Return to trouble-shooting chart

TROUBLE-SHOOTING PROGRAM (9)

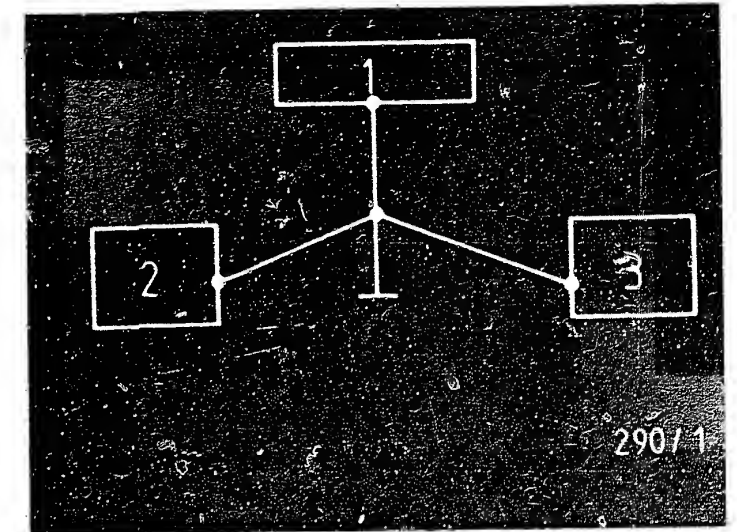


Testing common grounding point

For multi-component systems, all the components must have one common grounding point radiating out from the operating element, see illus.. System components such as the booster/equalizer must be fitted in an isolated position.

N>

Rectify the installation of the ground cables.
Fit system components such as the booster/equalizer in an isolated position.
By trying out, determine a new, more favorable, common grounding point.



1 = Car radio

2 = Booster/amplifier

3 = Equalizer

Trouble-shooting instructions : OPE-5003
BOSCH system : Motronic ML 4.1
Make of vehicle : OPEL
Basic microcard : PKW-050

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SPECIAL FEATURES

These trouble-shooting instructions, valid at the time of publication, apply to the following vehicle models:

- * OPEL Ascona und Kadett
with 2.0 l / 4-cylinder engine
Engine type OHC, C 20 NE, 20 NE,
20 SEH
(10.86 ->)
- * Motronic ML 4.1 with self-diagnosis
- * One common sensor for engine speed and reference mark
- * Single-winding rotary actuator
- * Lambda closed-loop control
- * Variant coding for octane-rating adaptation and transmission

Variant coding

Octane rating	Resistance at term. 15		
	2 l engine, low compression (9.2) without cat. converter	with cat. converter with cl.-loop control	2 l engine, high compression (10), without catal. converter
91 RON	0 Ω 1)	0 Ω 1)	—
	infinity Ω 2)	infinity Ω 2)	—
	—	750 Ω 2)3)5)	—
95 RON	220 Ω 1)	220 Ω 1)	220 Ω 1)
	1200 Ω 3)4)	1200 Ω 3)	1200 Ω 3)4)
	2200 Ω 2)	2200 Ω 2)	2200 Ω 2)
	4700 Ω 2)3)4)	4700 Ω 2)3)	4700 Ω 2)3)4)
	750 Ω 2)3)4)5)	—	infinity Ω 2)3)4)5)
98 RON	470 Ω 1)	—	470 Ω 1)
			750 Ω 2)

91 RON = Regular gasoline, unleaded or leaded, for vehicles without catalytic converter

95 RON = Premium gasoline, unleaded

98 RON = Premium gasoline, leaded

1) Basic value

2) Idle speed is increased by 100 min⁻¹.

3) Acceleration enrichment is enriched.

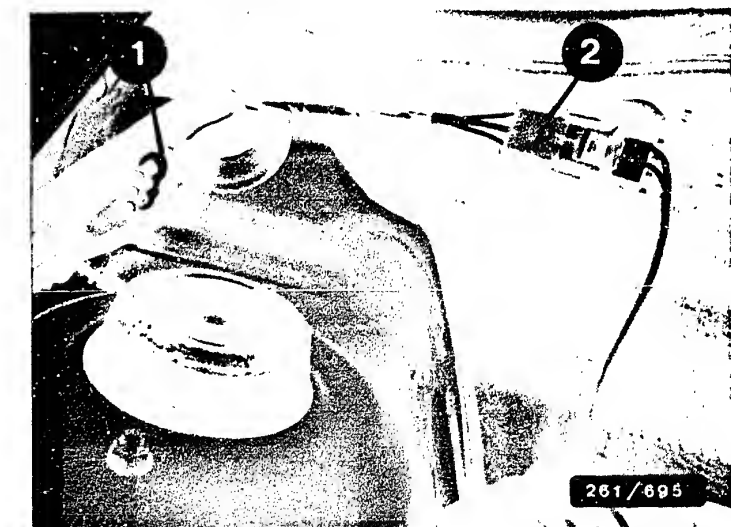
4) Mixture is enriched: lambda +5% corresponds to approx. 1% CO.

5) Ignition timing amounts to -5.25 ° crankshaft (retarded) throughout the whole characteristic-map range.



1 = Diagnostic plug
2 = Octane-rating encoding plug (term. 15)

1 = Encoding plug for term. 27
2 = Plug-in connection for lambda sensor



Vehicles with catalytic converter: term. 27 infinity Ω (open)

Vehicles without catalytic converter: term. 27 zero Ω (to ground)

Vehicles with manually shifted transmission:

term. 10 infinity Ω (open)

term. 28 zero Ω (to ground)

Vehicles with automatic transmission:

term. 10 zero Ω (to ground)

term. 28 to selection-lever positions P and N: zero Ω (via selection lever to ground). In

this way, idle speed is dropped in order to prevent driving off. In all other selection-lever positions, term. 28 is open (0 Ω)

STRUCTURE, USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to various causes/component faults.

For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to prevent damage to the engine, trigger boxes and control units or to the ignition system, be sure to observe the information in the basic instructions.

CAUTION!

High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

Avoid fuel injection while testing the compression!

Disconnect the Motronic relay.

TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)

- Starting motor operates, but engine fails to start or starts only with difficulty.
- Engine starts but then dies.
- Rough idling (engine speed, exhaust gas).
- Poor throttle response, flat spot during acceleration.
- Engine misfiring (ignition, injection).
- Maximum engine power/top speed not reached.
- Fuel consumption too high.
- Engine running on (dieseling).
- Engine pinging/knocking.
- Engine overheating.
- Fault lamp.

Cause (component fault)										
*	*	*	*	*	*	*	*	*	*	Self-diagnosis
*										Voltage at control unit
*										Sensor
*	*			*	*					Fuel pressure
*	*			*	*					Solenoid-operated injection valves
	*	*								Idle contact
				*						Full-load contact
	*	*	*	*	*	*				Air-flow sensor
	*	*	*							Idle actuator
*	*	*	*							Air-induction system
	*									Idle speed
*	*		*	*						Ignition coil
*	*	*	*	*						Primary signal
	*	*	*	*	*	*				Secondary pattern
*	*	*	*		*	*	*	*	*	Ignition point
	*									Exhaust gas
	*									Overrun cut-off
	*	*	*							Interference-suppression resistors
	*	*	*							Noise test
				*						Interference

TROUBLE-SHOOTING CHART (CONTINUED)

Customer complaint (symptoms of trouble)

- Starting motor operates but engine fails to start or starts only with difficulty.
- Engine starts but then dies.
- Rough idling (engine speed, exhaust gas).
- Poor throttle response, flat spot during acceleration.
- Engine misfiring (ignition, injection).
- Maximum engine power/top speed not reached.
- Fuel consumption too high.
- Engine running on (dieseling).
- Engine pinging/knocking.
- Engine overheating.
- Fault lamp.

Cause (component fault)										
				*					*	Throttle valve
				*						Fuel delivery
	*	*	*							Air bleed of tank
	*	*	*							Lambda closed-loop control
*	*	*	*	*	*	*	*	*	*	Control unit

SELF-DIAGNOSIS TEST TABLE

Fault indication Flash code	Testing of components/function	Test instructions/Test conditions	Terminals	Set values
1 2	Control unit/flashing-code output OK	Flashing-code output does not operate if fault lamp, supply leads to fault lamp and to diagnostic plug, and the current supply to the control unit are defective. If everything is O.K., but no flashing code is output, the control unit is defective.	4, 17	_____
1 3	Lambda sensor/voltage change	Break in lead to lambda sensor	24	_____
1 4	Temperature sensor (engine)/short circuit to ground	Test temperature sensor and lead for short circuit to ground.	13	_____
1 5	Temperature sensor (engine)/open circuit	Test temperature sensor and leads for open circuit. Temperature-sensor resistance : at +15...+30°C : at approx. +80°C :	13, ground	1450...3300 Ω 280...360 Ω
4 4	Lambda sensor/short circuit to ground	Test lead for short circuit to ground. Watch out for rubbed locations!	24	_____
4 5	Lambda sensor/short circuit to battery voltage	Test lead for short circuit to battery voltage. Watch out for rubbed locations!	24	_____
4 8	Supply voltage for control unit too low (with engine running)	Supply voltage: Test voltage drops at positive and ground terminals. Charge battery.	35(+), 5(-)	greater than 10 V
4 9	Supply voltage for control unit too high (with engine running)	Supply voltage: Test generator regulator.	35(+), 5(-)	less than 16 V

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Fault indication Flash code	Testing of components/function	Test instructions/Test conditions	Termi- nals	Set values
5 1	Control unit/digital component	Control unit defective	—	—
6 5	Idle potentiometer for CO adjustment/ voltage too low	Measure resistance of potentiometer. Test lead for short circuit to ground. Term. 9 interrupted. Term. 6 and term. 9 bridged.	30	Measure resistance at air- flow sensor between term. 1 and term. 4: Minimum 0...30 Ω Maximum: The value measured between term. 3 and term. 4 may be up to 30 Ω less. (Set value between term. 3 and term. 4: 300 ...550 Ω)
6 6	Idle potentiometer for CO adjustment/ voltage too high	Measure resistance of potentiometer. Test potentiometer and leads for open circuits and short circuits to battery voltage. If term. 6 interrupted, fault code 7 4 comes as well.	30	
6 7	Throttle-valve switch/ idle contact	Fault: idle contact permanently closed. Idle contact closed in rest position: Actuate throttle valve slightly:	2, ground	0 Ω infinity Ω
6 9	Temperature sensor (air)/short circuit to ground	Test temperature sensor and lead for short circuit to ground.	22	—
7 1	Temperature sensor (air)/open circuit	Test temperature sensor and leads for open circuit. Temperature-sensor resistance: at +15°C...+30°C:	22,6(-)	1450...3300 Ω
7 2	Throttle-valve switch/ full-load contact	Fault: full-load contact permanently closed. Fault lamp lights up only intermittently in overrun. Full-load with contact closed in full-throttle position: Release accelerator pedal slightly:	3	0 Ω infinity Ω

SELF-DIAGNOSIS TABLE (CONTINUED)

Fault indication Flash code	Testing of components/function	Test instructions, test conditions	Termi- nals	Set values
7 3	Air-flow sensor/short circuit to ground	Test lead to term. 7 for short circuit to ground. Break in lead to term. 7 and term. 9, or term. 6 and term. 9 bridged.	6,7,9	—
7 4	Air-flow sensor/open circuit	Test lead to term. 6 for open circuit. (Fault code 6 6 also appears). Test leads to term. 6 and term. 7 for short circuit to positive (5 V or battery positive). Test resistances of air-flow sensor: : between term. 6 and term. 7 (deflect air-flow sensor flap): between term. 6 and term. 9 :	6(-), 7	8...2500 Ω 300...550 Ω
7 5	Transmission switch/ short circuit to ground	Fault: switch permanently closed. Test lead for short circuit to ground.	8	—

TEST SPECIFICATIONS

Pressure regulator

* Fuel pressure 2,3...2,7 bar

Electric fuel pump

* Fuel delivery
(measured in return line) at least 850 cm³ /30s
Supply voltage
(under load): at least 12 V

Temperature sensor (air)

* Internal electrical resistance
measured at air-flow sensor
between term. 4 and term. 5
at ambient temperature
(+15°C...+30°C): 1450...3300 Ω

Temperature sensor (engine), plug color, blue.

* Internal electrical resistance
at ambient temperature
(+ 15° C...+ 30° C): 1450...3300 Ω
with engine at normal operating temperature
(approx. + 80° C): 280...360 Ω

Solenoid-operated injection valve

* Internal electrical resistance
at ambient temperature
(+ 15° C...+ 30° C): 14,5...17 Ω

Air-flow sensor

* Internal electrical resistance between:
term.2 and term.4 : 8...2500 Ω (1)
term.3 and term.4 : 300... 550 Ω
term.1 and term.4 (CO potentiometer):
Minimum 0... 30 Ω
Maximum: the actual value measured between
term.3 and term.4 is permitted to be up to
30 Ω less.

(1) Deflect air-flow sensor flap slowly as
far as it will go.
Resistance fluctuates between the
terminals of the potentiometer.

TEST SPECIFICATIONS (CONTINUED)

Engine-speed sensor and reference-mark sensor

* Internal electrical resistance
at ambient temperature
(+15°C...+30°C): 400...800 Ω
* Air gap: 0,8±0,5 mm

Throttle-valve switch

* Resistance value of idle contact
term.1 and term.2): 0 Ω
* Resistance value of full-load
contact (term.1 and term.3) 0 Ω

Pressure sensor (altitude sensor)

* Total resistance between
term.3(+) and term.2(-) : 2300...2500 Ω
* Resistance between wiper
term.1(S) and term.2(-) : 400...2300 Ω
Test specification is altitude-dependent

Idle actuator

* Internal electrical resistance
at +15°...+30°C : approx. 8 Ω

Lambda sensor

* Resistance value of heater winding 1...15 Ω

Ignition coil

* Primary resistance approx. 0 Ω
* Secondary resistance 5000...7200 Ω

Interference-suppression resistors

* High-voltage distributor rotor: 1 k Ω
The secondary side of the ignition system must be
interference-suppressed with at least 5k Ω total
resistance. High-voltage resistance cables are
installed as standard.

TEST SPECIFICATIONS (CONTINUED)

Idle test:

Engine at normal operating temp.,
switch off consuming devices.

- * Idle speed: 740 \pm 40 min -1 +)
- * Spark advance: 10 \pm 5 ° crankshaft +)

Automatic transmission at N or P

CO-content: without cat. converter

% CO by vol. 0,1...1 +)

Adjust mixture at CO
potentiometer in air-flow
sensor:

Turning counterclockwise results in a leaner mixture,
turning clockwise results in a richer mixture.

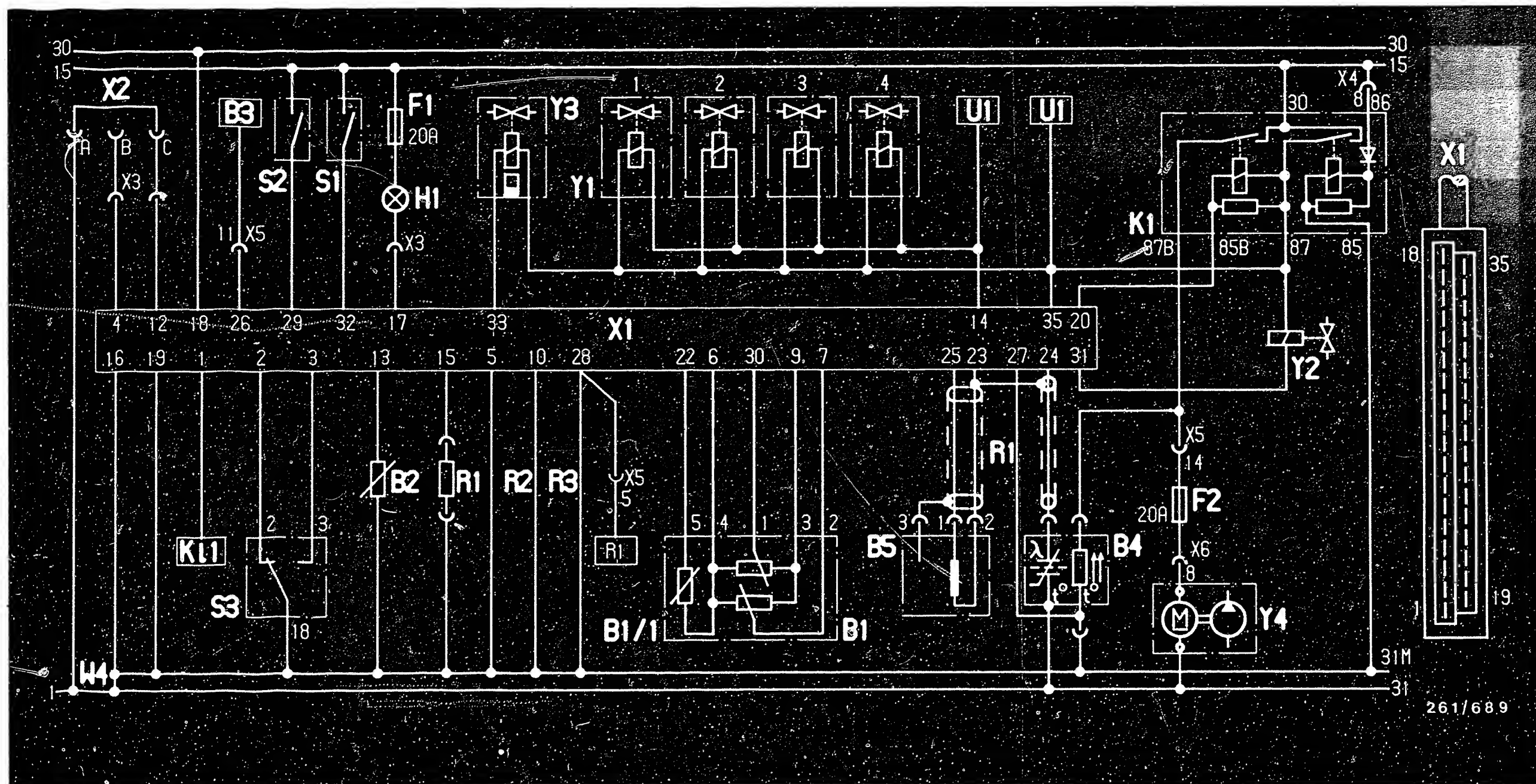
Using the potentiometer, the duration of
injection can be adjusted by max. 0,5 ms

- * Catalytic-converter vehicles:: 0 % CO by vol.

For production reasons:
continued on the following
coordinate.

-
- +) Attention! The basic value stated may deviate due to
variant coding. Observe table in "Special features"
section.

See equipment and Autodata microcards for
setting values for valve clearance and other
engine-specific data.

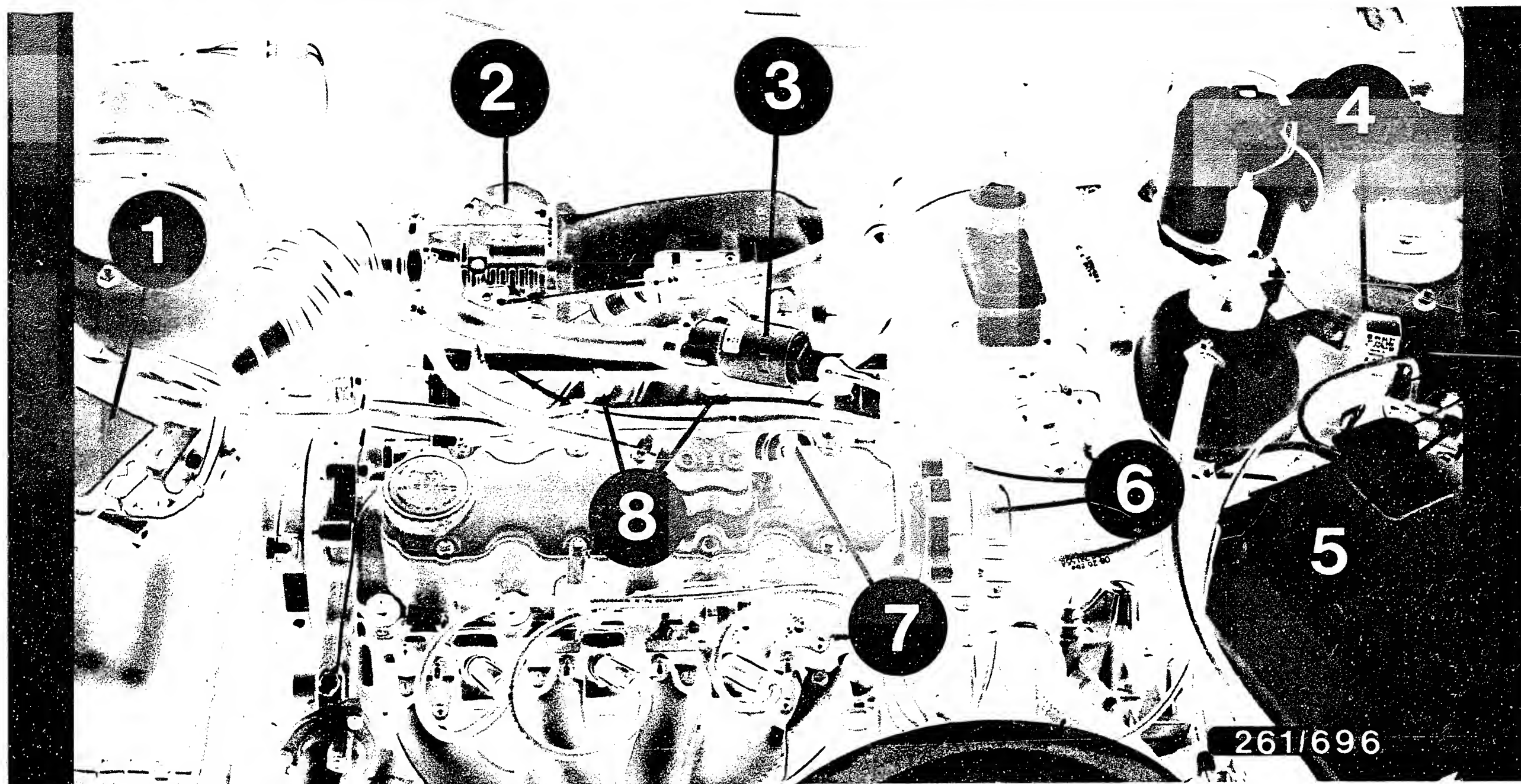


ELECTRICAL TERMINAL DIAGRAM

B1 = Air-flow sensor
B1/1= Temperature sensor (air)
B2 = Temperature sensor (engine)
B3 = Distance travelled sensor
B4 = Lambda sensor
B5 = Eng.-speed/ref.-mark sensor
F1,F2 = Fuse 20A

H1 = Fault lamp
K1 = Motronic relay
Term. 1 = Ignition coil term. 1
R1 = See variant coding
R2 = For automatic trans. only
R3 = For man. shifted trans. only
S1 = Switch, compressor
S2 = Air conditioner
S3 = Throttle-valve switch

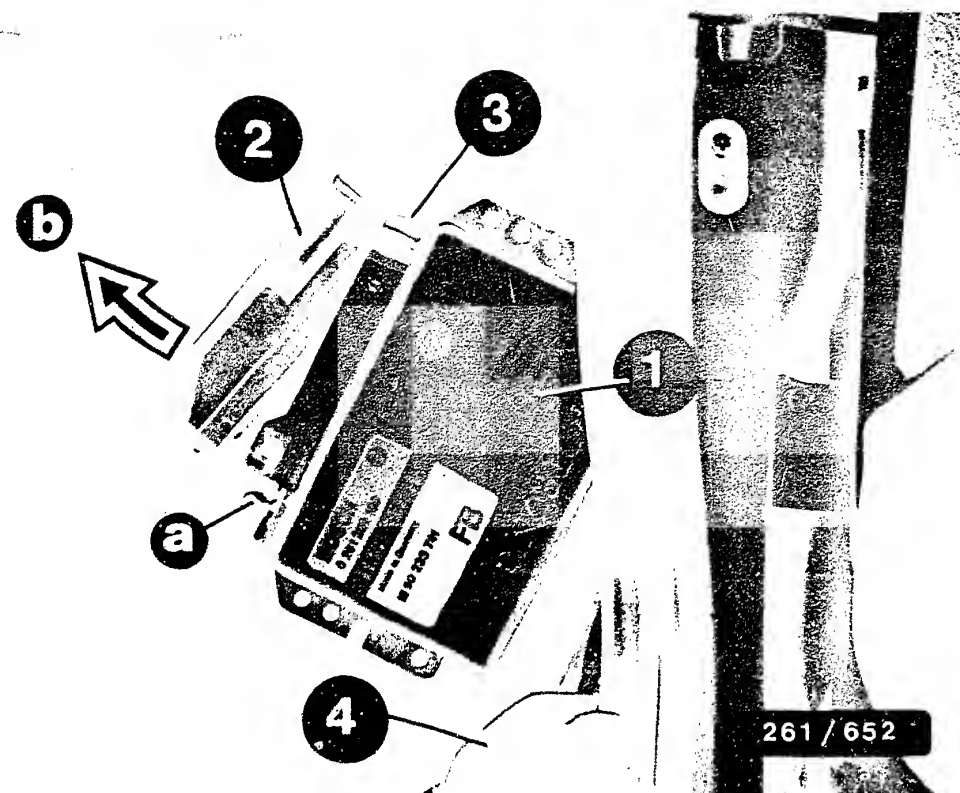
U1 = On board computer
W4 = Ground strap, engine
X1 = Motronic control-unit plug
X2 = Diagnostic plug
Y1 = Injection valve
Y2 = Tank bleeder valve
Y3 = Idle actuator
Y4 = Electric fuel pump



INSTALLATION POSITION OF COMPONENTS

1 = Air-flow sensor
 2 = Throttle-valve switch
 3 = Idle actuator
 4 = Motronic relay

5 = Ignition coil
 6 = High-voltage distrib.
 7 = Pressure regulator
 8 = Injection valve

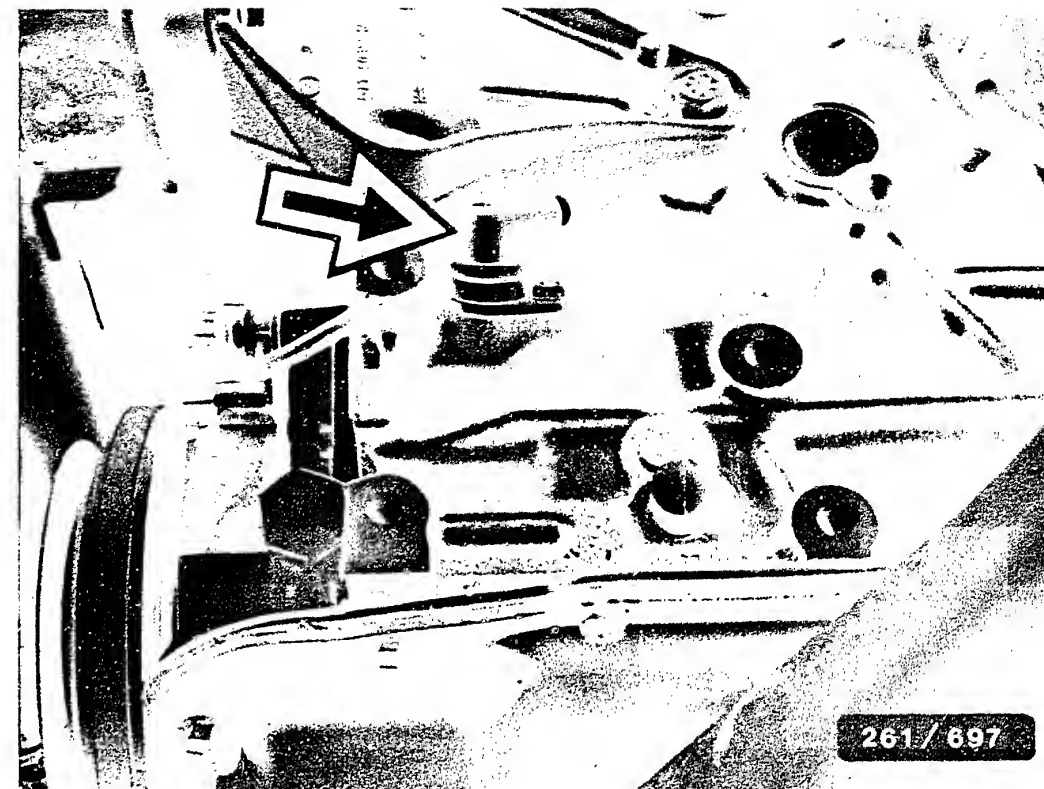


- 1 = Control unit
- 2 = Plug
- 3 = Mechanical encoding with locking lug
- 4 = Cover over door sill

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

The indications "left" and "right" refer always to the forward direction of travel.

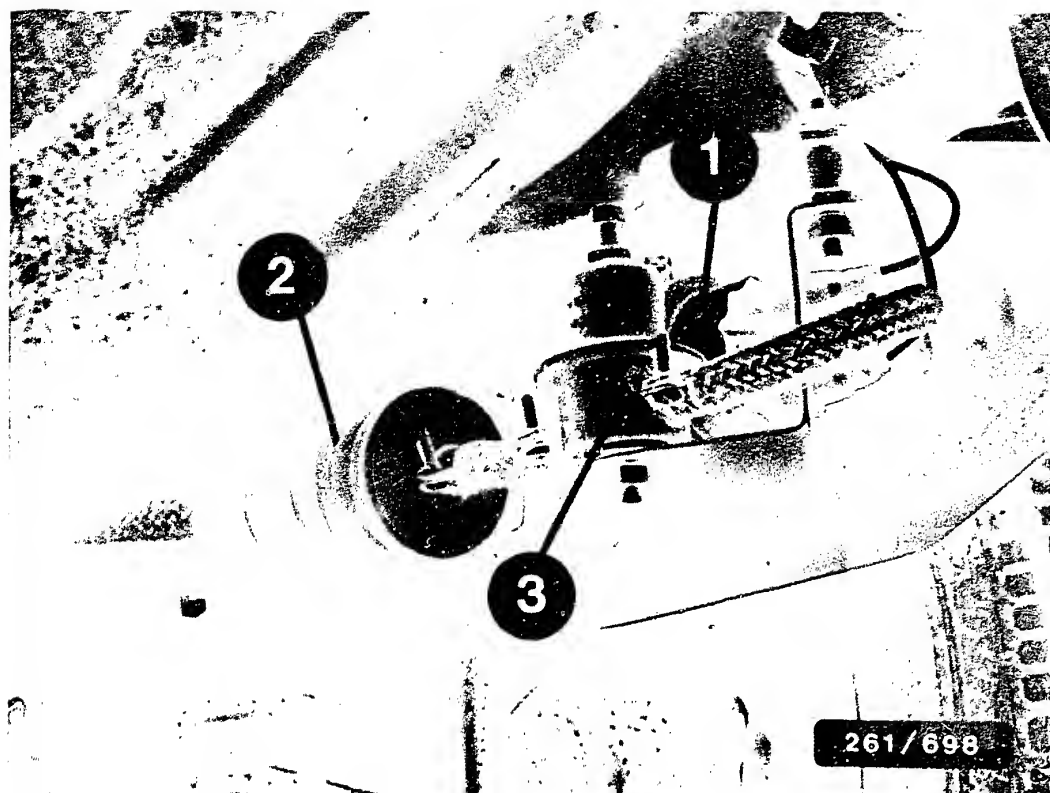
- * Control unit:
In front-passenger footwell on right-hand side. Slightly raise rubber strip and cover on door sill. Fold carpet to side and remove control-unit cover. Unscrew control unit. Unlock plug (a), hinge (arrow b) and unhook (Item 3).
- * Temperature sensor (engine):
In engine block below mounting of alternator.



Arrow = Reference-mark/engine-speed sensor

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

- * Reference-mark/engine-speed sensor:
In engine block at front left, below fastening flange.
- * Lambda sensor:
In common exhaust pipe before catalytic converter.
- * Fuses:
In instrument panel at bottom left. Fuse box can be hinged out on its lower side.
- * Temperature sensor (air):
In air-flow sensor



- 1 = Electric fuel pump
- 2 = Fuel filter
- 3 = Pressure damper

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

- * Electric fuel pump and fuel filter:
Between the fuel tank and right-hand rear wheel.
- * Ground terminals:
On the engine block at the front on the right, beneath the engine-oil filler-neck cap.
- * Diagnostic plug:
In the engine compartment on the right at the spring-strut dome.
- * Octane-rating encoding plug:
In the engine compartment on the right at the spring-strut dome.

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

- * Tank bleeder valve:
In the engine compartment on the left next to the ignition coil.
- * Carbon filter:
In the engine compartment on the left next to the battery.

Trouble-shooting instructions : OPE-5004
 BOSCH system : Motronic ML 4.1
 Make of vehicle : OPEL
 Basic microcard : PKW-050

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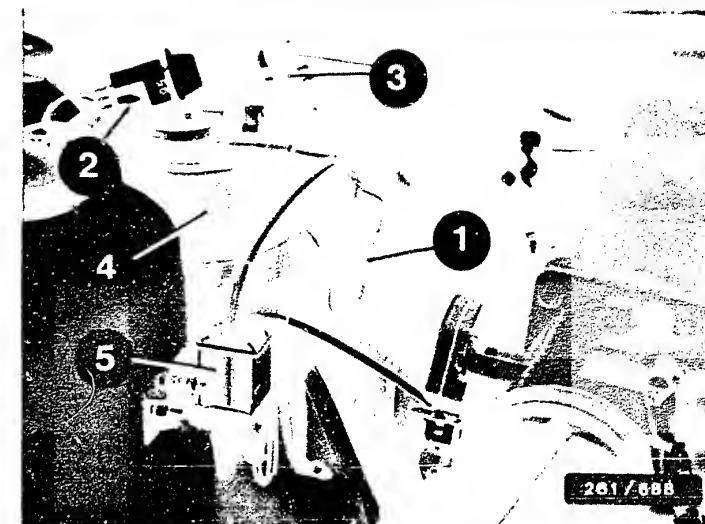
SPECIAL FEATURES

These trouble-shooting instructions, valid at the time of publication, apply to the following vehicle model:

- * OPEL Omega
with 2,0 l / 4-cylinder engine
Engine type OHC, C 20 NE and 20 SE
(10.86 ->)
- * Motronic ML 4.1 with self-diagnosis
- * One common sensor for engine speed and reference mark
- * Single-winding rotary actuator
- * Lambda closed-loop control
- * Variant coding for octane-rating adaptation and transmission

Variant coding

Octane rating	Resistance at term. 15		2 l engine, high compression (10), without catal. converter
	2 l engine, low compression (9.2) without cat. converter	with cat. converter with cl.-loop control	
91 RON	0 Ω 1)	0 Ω 1)	—
	infinity Ω 2)	infinity Ω 2)	—
	—	750 Ω 2)3)5)	—
95 RON	220 Ω 1)	220 Ω 1)	220 Ω 1)
	1200 Ω 3)4)	1200 Ω 3)	1200 Ω 3)4)
	2200 Ω 2)	2200 Ω 2)	2200 Ω 2)
	4700 Ω 2)3)4)	4700 Ω 2)3)	4700 Ω 2)3)4)
	750 Ω 2)3)4)5)	—	infinity Ω 2)3)4)5)
98 RON	470 Ω 1)	—	470 Ω 1)
			750 Ω 2)



- 1 = Diagnostic plug
- 2 = Octane-rating encoding plug
- 3 = Encoding plug for term .27
- 4 = Carbon filter
- 5 = Tank ventilation valve

91 RON = Regular gasoline, unleaded or leaded, for vehicles without catalytic converter

95 RON = Premium gasoline, unleaded

98 RON = Premium gasoline, leaded

1) Basic value

2) Idle speed is increased by 100 min⁻¹.

3) Acceleration enrichment is enriched.

4) Mixture is enriched: lambda +5% corresponds to approx. 1% CO.

5) Ignition timing amounts to -5.25 ° crankshaft (retarded) throughout the whole characteristic-map range.

Vehicles with catalytic converter: term. 27 infinity Ω (open)

Vehicles without catalytic converter: term. 27 zero Ω (to ground)

Vehicles with manually shifted transmission:

term. 10 infinity Ω (open)

term. 28 zero Ω (to ground)

Vehicles with automatic transmission:

term. 10 zero Ω (to ground)

term. 28 to selection-lever posi-

tions P and N: zero Ω (via

selection lever to ground). In

this way, idle speed is dropped in

order to prevent driving off. In

all other selection-lever posi-

tions, term. 28 is open (0 Ω)

STRUCTURE, USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to various causes/component faults.

For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to prevent damage to the engine, trigger boxes and control units or to the ignition system, be sure to observe the information in the basic instructions.

CAUTION!

High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

Avoid fuel injection while testing the compression!

Disconnect the Motronic relay.

TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Rough idling (engine speed, exhaust gas).
4. Poor throttle response, flat spot during acceleration.
5. Engine misfiring (ignition, injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

Cause (component fault)										
*	*	*	*	*	*	*	*	*	*	Self-diagnosis
*										Voltage at control unit
*										Sensor
*	*			*	*					Fuel pressure
*	*			*	*					Solenoid-operated injection valves
	*	*								Idle contact
				*						Full-load contact
	*	*	*	*	*	*				Air-flow sensor
	*	*	*							Idle actuator
*	*	*	*							Air-induction system
	*									Idle speed
*	*		*	*						Ignition coil
*	*	*	*	*						Primary signal
	*	*	*	*	*	*				Secondary pattern
*	*	*	*		*	*		*	*	Ignition point
	*									Exhaust gas
	*									Overrun cut-off
	*	*	*							Interference-suppression resistors
	*	*	*							Noise test
				*						Interference

TROUBLE-SHOOTING CHART (CONTINUED)

Customer complaint (symptoms of trouble)

1. Starting motor operates but engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Rough idling (engine speed, exhaust gas).
4. Poor throttle response, flat spot during acceleration.
5. Engine misfiring (ignition, injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

Cause (component fault)										
				*					*	Throttle valve
				*						Fuel delivery
	*	*	*							Air bleed of tank
	*	*	*							Lambda closed-loop control
*	*	*	*	*	*	*	*	*	*	Control unit

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Fault indication Flash code	Testing of components/function	Test instructions/Test conditions	Termi- nals	Set values
5 1	Control unit/digital component	Control unit defective	—	—
6 5	Idle potentiometer for CO adjustment/ voltage too low	Measure resistance of potentiometer. Test lead for short circuit to ground. Term. 9 interrupted. Term. 6 and term. 9 bridged.	30	Measure resistance at air- flow sensor between term. 1 and term 4: Minimum 0...30 Ω Maximum: The value measured between term. 3 and term. 4 may be up to 30 Ω less. (Set value between term. 3 and term. 4: 300 ...550 Ω)
6 6	Idle potentiometer for CO adjustment/ voltage too high	Measure resistance of potentiometer. Test potentiometer and leads for open circuits and short circuits to battery voltage. If term. 6 interrupted, fault code 7 4 comes as well.	30	
6 7	Throttle-valve switch/ idle contact	Fault: idle contact permanently closed. Idle contact closed in rest position: Actuate throttle valve slightly:	2, ground	0 Ω infinity Ω
6 9	Temperature sensor (air)/short circuit to ground	Test temperature sensor and lead for short circuit to ground.	22	—
7 1	Temperature sensor (air)/open circuit	Test temperature sensor and leads for open circuit. Temperature-sensor resistance: at +15°C...+30°C:	22,6(-)	1450...3300 Ω
7 2	Throttle-valve switch/ full-load contact	Fault: full-load contact permanently closed. Fault lamp lights up only intermittently in overrun. Full-load with contact closed in full-throttle position: Release accelerator pedal slightly:	3	0 Ω infinity Ω

SELF-DIAGNOSIS TABLE (CONTINUED)

Fault indication Flash code	Testing of components/function	Test instructions/Test conditions	Terminals	Set values
7 3	Air-flow sensor/short circuit to ground	Test lead to term. 7 for short circuit to ground. Break in lead to term. 7 and term. 9, or term. 6 and term. 9 bridged.	6,7,9	—
7 4	Air-flow sensor/open circuit	Test lead to term. 6 for open circuit. (Fault code 6 6 also appears). Test leads to term. 6 and term. 7 for short circuit to positive (5 V or battery positive). Test resistances of air-flow sensor: : between term. 6 and term. 7 (deflect air-flow sensor flap): between term. 6 and term. 9 :	6(-), 7	8...2500 Ω 300...550 Ω
7 5	Transmission switch/short circuit to ground	Fault: switch permanently closed. Test lead for short circuit to ground.	8	—

TEST SPECIFICATIONS

Pressure regulator	
* Fuel pressure	2,3...2,7 bar
Electric fuel pump	
* Fuel delivery (measured in return line)	at least 850 cm ³ /30s
Supply voltage (under load):	at least 12 V
Temperature sensor (air)	
* Internal electrical resistance measured at air-flow sensor between term. 4 and term. 5 at ambient temperature (+15°C...+30°C):	1450...3300 Ω
Temperature sensor (engine), plug color, blue.	
* Internal electrical resistance at ambient temperature (+ 15° C...+ 30° C):	1450...3300 Ω
with engine at normal operating temperature (approx. + 80° C):	280....360 Ω
Solenoid-operated injection valve	
* Internal electrical resistance at ambient temperature (+ 15° C...+ 30° C):	14,5.....17 Ω
Air-flow sensor	
* Internal electrical resistance between:	
term.2 and term.4 :	8...2500 Ω (1)
term.3 and term.4 :	300....550 Ω
term.1 and term.4 (CO potentiometer):	
Minimum	0...30 Ω
Maximum: the actual value measured between term.3 and term.4 is permitted to be up to 30 Ω less.	
(1) Deflect air-flow sensor flap slowly as far as it will go. Resistance fluctuates between the terminals of the potentiometer.	

TEST SPECIFICATIONS (CONTINUED)

Engine-speed sensor and reference-mark sensor	
* Internal electrical resistance at ambient temperature (+15°C...+30°C):	400...800 Ω
* Air gap:	0,8 ±0,5 mm
Throttle-valve switch	
* Resistance value of idle contact term.1 and term.2):	0 Ω
* Resistance value of full-load contact (term.1 and term.3)	0 Ω
Pressure sensor (altitude sensor)	
* Total resistance between term.3(+) and term.2(-) :	2300...2500 Ω
* Resistance between wiper term.1(S) and term.2(-) :	400...2300 Ω
Test specification is altitude-dependent	
Idle actuator	
* Internal electrical resistance at +15°...+30°C :	approx. 8 Ω
Lambda sensor	
* Resistance value of heater winding	1...15 Ω
Ignition coil	
* Primary resistance	approx. 0 Ω
* Secondary resistance	5000...7200 Ω
Interference-suppression resistors	
* High-voltage distributor rotor:	1 k Ω
The secondary side of the ignition system must be interference-suppressed with at least 5k Ω total resistance. High-voltage resistance cables are installed as standard.	

TEST SPECIFICATIONS (CONTINUED)

Idle test:

Engine at normal operating temp.,
switch off consuming devices.

- * Idle speed: 740 ± 40 min -1 +)
- * Spark advance: 10 ± 5 ° crankshaft +)

Automatic transmission at N or P

CO-content: without cat. converter

% CO by vol. 0,1...1 +)

Adjust mixture at CO
potentiometer in air-flow
sensor:

Turning counterclockwise results in a leaner mixture,
turning clockwise results in a richer mixture.

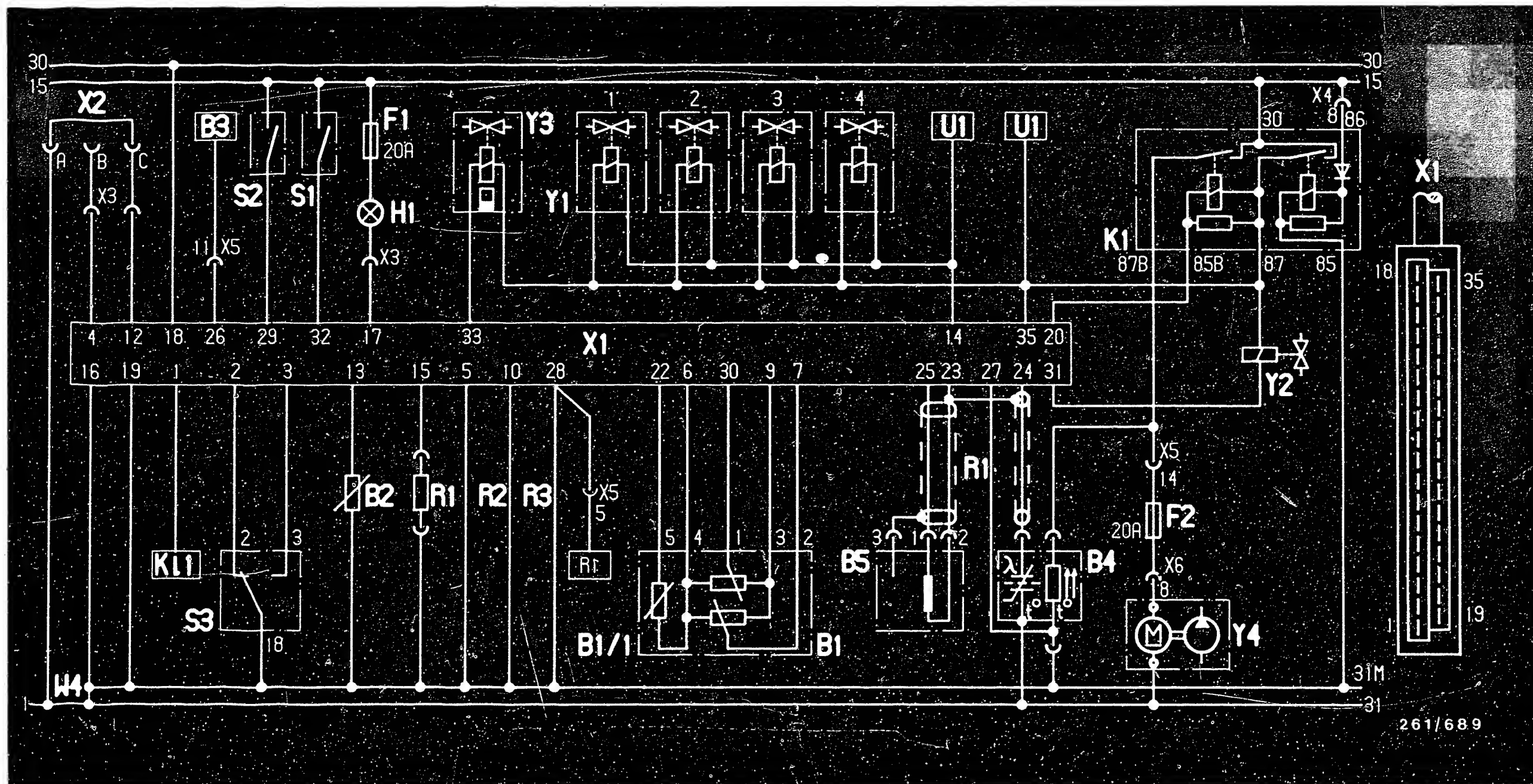
Using the potentiometer, the duration of
injection can be adjusted by max. 0,5 ms

- * Catalytic-converter vehicles:: 0 % CO by vol.

For production reasons:
continued on the following
coordinate.

- +) Attention! The basic value stated may deviate due to
variant coding. Observe table in "Special features"
section.

See equipment and Autodata microcards for
setting values for valve clearance and other
engine-specific data.

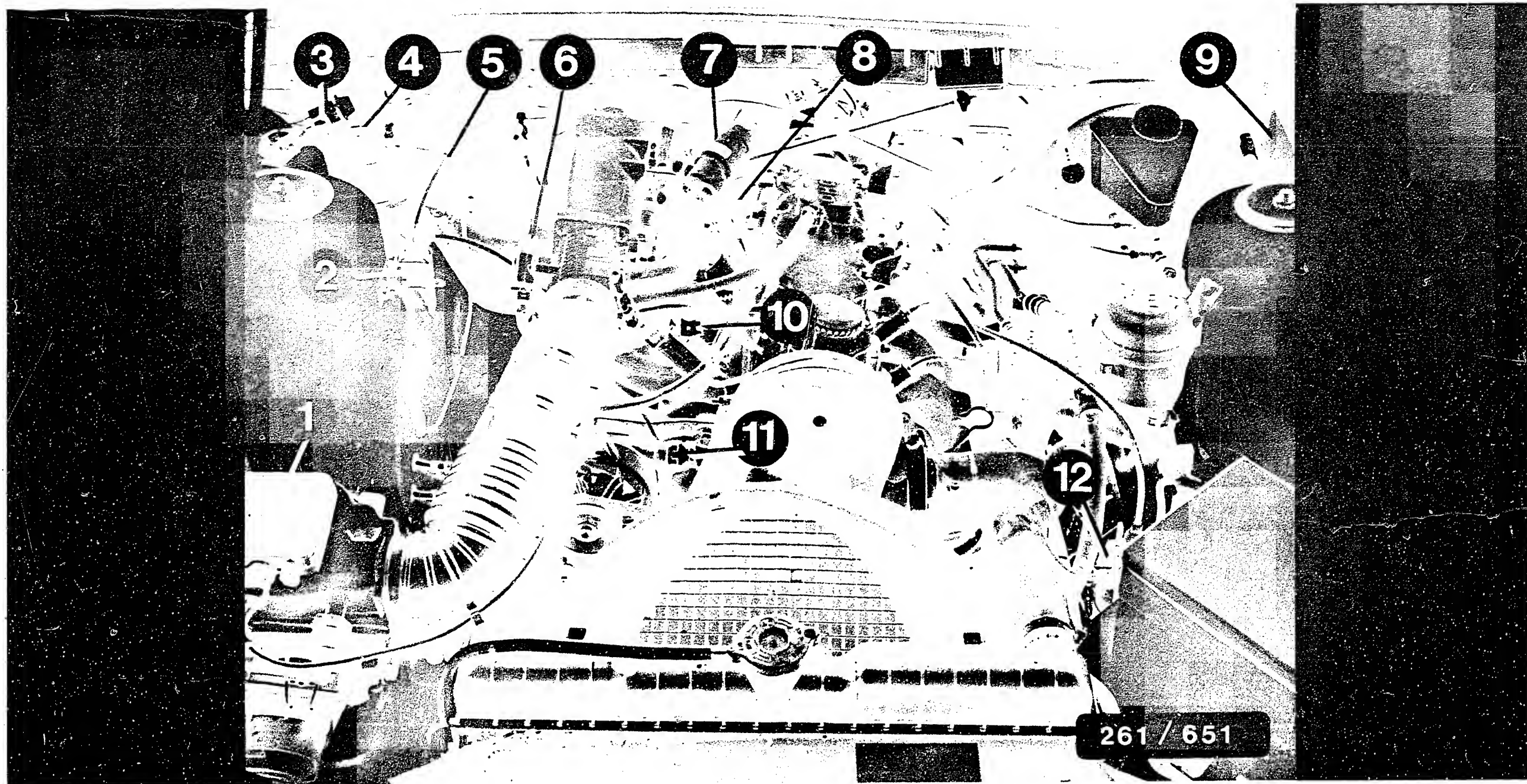


ELECTRICAL TERMINAL DIAGRAM

B1 = Air-flow sensor
 B1/1= Temperature sensor (air)
 B2 = Temperature sensor (engine)
 B3 = Distance travelled sensor
 B4 = Lambda sensor
 B5 = Eng.-speed/ref.-mark sensor
 F1,F2 = Fuse 20A

H1 = Fault lamp
 K1 = Motronic relay
 Term. 1 = Ignition coil term. 1
 R1 = See variant coding
 R2 = For automatic transm. only
 R3 = For man. shifted transm. only
 S1 = Switch, compressor
 S2 = Air conditioner
 S3 = Throttle-valve switch

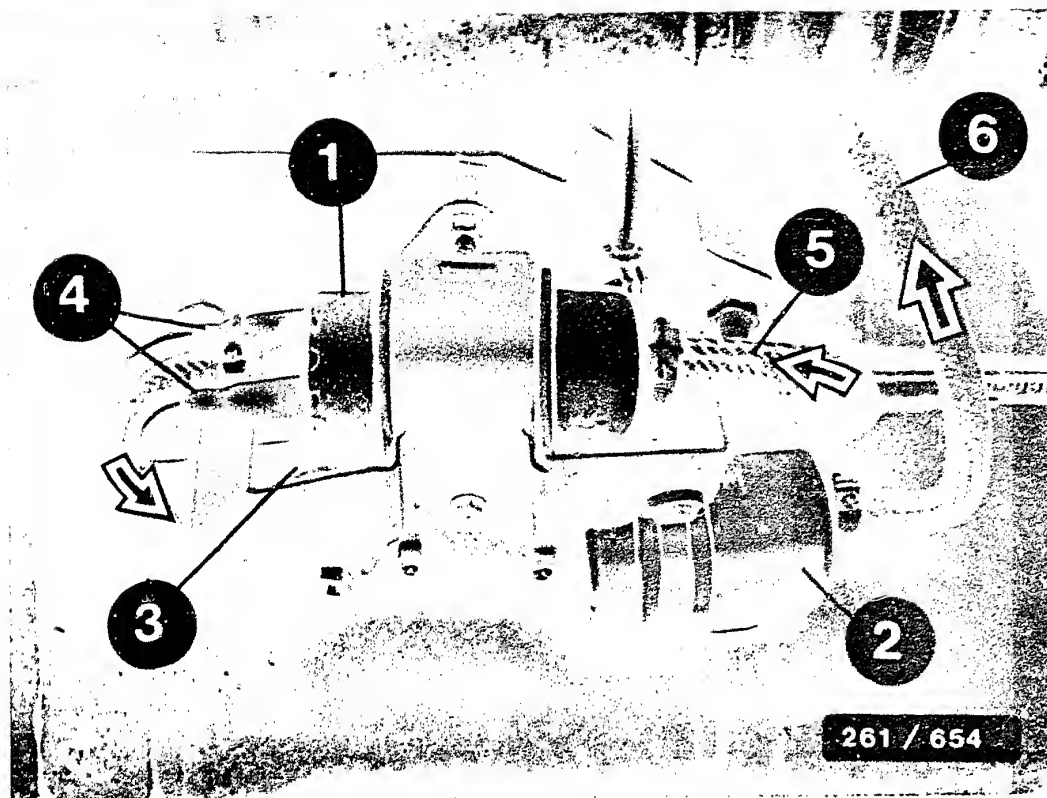
U1 = On board computer
 W4 = Ground strap, engine
 X1 = Motronic control-unit plug
 X2 = Diagnostic plug
 Y1 = Injection valve
 Y2 = Tank bleeder valve
 Y3 = Idle actuator
 Y4 = Electric fuel pump



INSTALLATION POSITION OF COMPONENTS

1 = Air-flow sensor
 2 = Tank-ventilation valve
 3 = Octane-number encoding plug
 4 = Active-carbon filter
 5 = Diagnostic plug
 6 = Throttle-valve switch

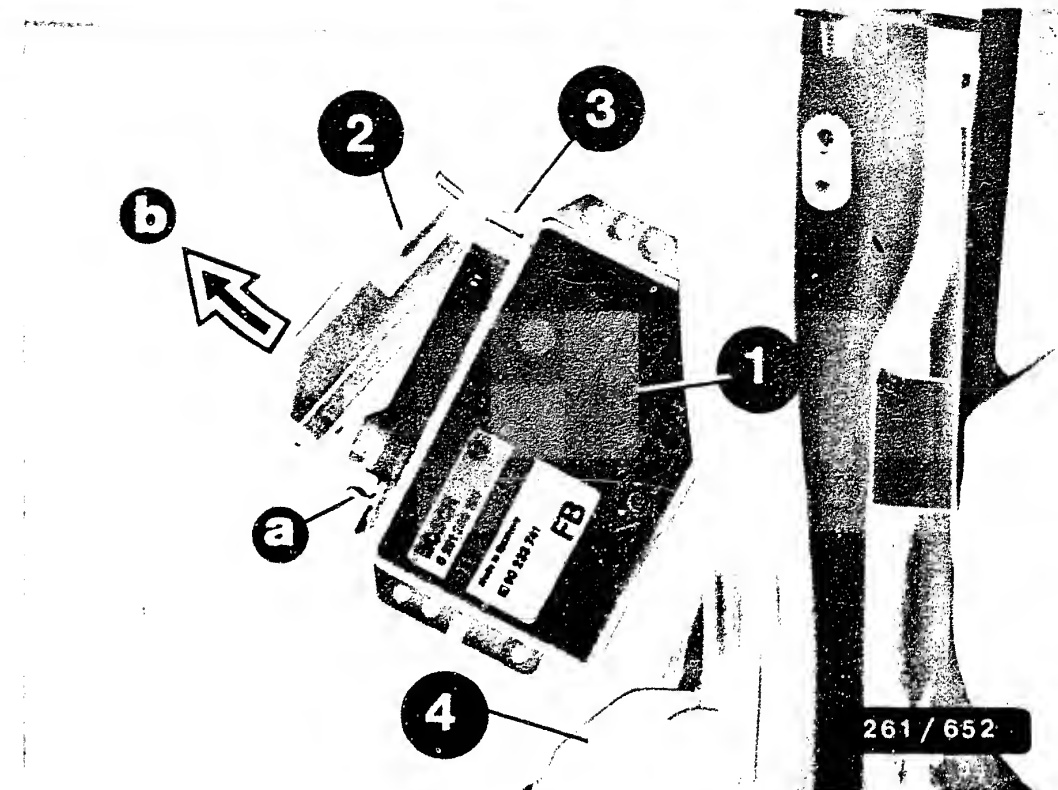
7 = Idle actuator
 8 = Pressure regulator
 9 = Motronic relay
 10 = Injection valves
 11 = Temperature sensor (engine)
 12 = Ignition coil



- 1 = Electric fuel pump
- 2 = Fuel filter
- 3 = Pressure damper

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

- * Electric fuel pump and fuel filter:
In front of fuel tank.
- * Ground terminals:
On engine block at front right, under screw cover for engine oil.
- * Diagnostic plug:
In engine compartment on right on firewall.
- * Octane-number encoding plug:
In engine compartment on right on firewall.



- 1 = Control unit
- 2 = Plug
- 3 = Mechanical encoding with locking lug
- 4 = Cover over door sill

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

The indications "left" and "right" refer always to the forward direction of travel.

- * Control unit:
In front-passenger footwell on right-hand side. Slightly raise rubber strip and cover on door sill. Fold carpet to side and remove control-unit cover. Unscrew control unit. Unlock plug (a), hinge (arrow b) and unhook (Item 3).
- * Temperature sensor (engine):
In engine block below mounting of alternator.



Arrow = Reference-mark/engine-speed sensor

For production reasons:
continued on the following
coordinate.

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

- * Reference-mark/engine-speed sensor:
In engine block at front left, below
fastening flange.
- * Lambda sensor:
In common exhaust pipe before catalytic
converter.
- * Fuses:
In instrument panel at bottom left.
Fuse box can be hinged out on its lower
side.
- * Temperature sensor (air):
In air-flow sensor

TABLE OF CONTENTS

Trouble-shooting instructions: MB-5031

BOSCH system : Headlight vertical aim control (LWR)

Vehicle make : Mercedes-Benz

Basic microcard : MB-524

Section	Coordinate
Special features, safety, usage	02
Trouble-shooting chart	04
Rapid diagnosis chart for the headlight aiming device	05
Test specifications	09
Diagram of air lines	10
Installation position of components	11

SPECIAL FEATURES

* This microcard contains the trouble-shooting instructions for headlight vertical aim control for the following models, valid at the time of compilation:

Mercedes-Benz
Type W201 : 190 D...190 E (09.87 ->)
Type W124 : 200 D...300TE (09.87 ->)
Type W126: 260SE...560SEL (09.87 ->)
Type C126:420SEC...560SEC (09.87 ->)

* A shutoff valve has been fitted additionally at the rheostat-type switch of the headlight vertical aim control system. As a result the vacuum supply tank is no longer fitted, nor the vacuum lines and non-return valves needed for this.

STRUCTURE, USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to various causes/component faults. Detailed instructions for trouble-shooting must be taken from the basic instructions via the trouble-shooting chart.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

Finding individual test steps in the brief and basic instructions is made easier by identical test-step numbering.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to prevent damage to the engine, control unit or ignition system, be sure to observe the safety and precautionary measures in the basic instructions.

* C A U T I O N !
High-performance ignition system.
Dangerous primary and secondary voltages.

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

See basic instructions for further precautionary measures.

TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

- 1. Headlight setting too high or too low.
- 2. Headlight cannot be adjusted by LWR system.
- 3. Light/dark boundary flickers during driving.

Cause (component fault)	
*	Check basic headlight setting
* *	Headlight mechanically defective
*	Vacuum system leaking
*	Actuator defective
*	Rheostat-type switch defective
*	Non-return valve defective
*	Mounting of actuator defective

RAPID DIAGNOSIS CHART FOR TESTING WITH HEADLIGHT AIMING DEVICE 0 681 130 .. OR 0 684 100 ..
Perform tests on both headlights in each case!

Vehicles without level control

Test step	Function	Remarks	Set headlight aiming device to:	Set headlights to:	Reading on headlight aiming device
1	Basic headlight setting	Set rheostat-type switch to: "0" position (basic setting). Engine running.	10 cm inclination	Light/dark boundary	—
2	Maximum adjustment	Set rheostat-type switch to: "3" position. Engine running.	Light/dark boundary	—	Between 33 cm and 48 cm
3	Basic setting	Set rheostat-type switch to: "0" position (basic setting). Engine running.	10 cm inclination	—	Light/dark boundary
4	Leakage in vacuum system	Set rheostat-type switch to: "0" position (basic setting). Switch off engine.	10 cm inclination	—	Light/dark boundary may move by max. ± 3 cm

RAPID DIAGNOSIS CHART FOR TESTING WITH HEADLIGHT AIMING DEVICE 0 681 130 .. OR 0 684 100 ..
Perform tests on both headlights in each case!

Vehicles with level control and T-models

Test step	Function	Remarks	Set headlight aiming device to:	Set headlights to:	Reading on headlight aiming device
1 a	Basic headlight setting	Set rheostat-type switch to: "0" position (basic setting). Engine running.	10 cm inclination	Light/dark boundary	—
2 a	Maximum low adjustment	Set rheostat-type switch to: "2" position. Engine running.	Light/dark boundary	—	Between 28 cm and 35 cm
3 a	Maximum high adjustment	Set rheostat-type switch to: "0" position (basic setting). Engine running.	23 cm inclination	Light/dark boundary	—
		Set rheostat-type switch to: "1" position (adjustment upwards). Engine running.	Light/dark boundary	—	Between 10 cm and 16 cm
4 a	Basic setting	Set rheostat-type switch to: "0" position (basic setting). Engine running.	10 cm inclination	Light/dark boundary	—
5 a	Leakage in vacuum system	Set rheostat-type switch to: "0" position (basic setting). Switch off engine.	10 cm inclination	—	Light/dark boundary may move by max. ± 3 cm

TEST SPECIFICATIONS

Adjustment travel of the actuators:

Vehicles without level control

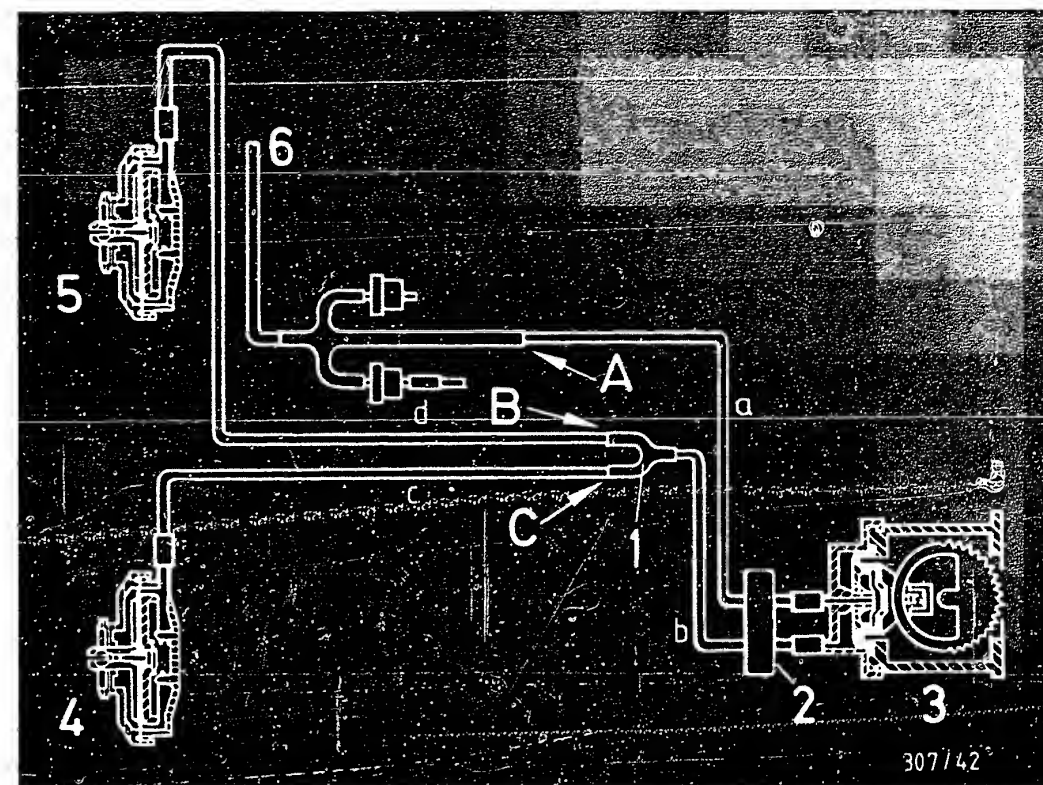
Adjustment min. 2,8 mm

Vehicles with level control

Upper adjustment min. 0,6 mm

Lower adjustment min. 1,7 mm

Basic headlight setting: H - 10 cm



DIAG.OF AIR LINES OF THE HEADLIGHT VERT. AIM CONTROL SYS.

A,B,C = Test connections

- a = Line to shutoff valve at rheostat-type switch, input
- b = Line to shutoff valve at rheostat-type switch, output
- c = Line to actuator, left
- d = Line to actuator, right

- 1 = Branch piece
- 2 = Shutoff valve
- 3 = Rheostat-type switch
- 4 = Actuator, left
- 5 = Actuator, right
- 6 = From vacuum connection on engine

INSTALLATION POSITION OF COMPONENTS

The installation position of the components is the same as in the basic instructions. The shutoff valve is mounted directly on the rheostat-type switch.

For production reasons:
continued on the following
coordinate.

Trouble-shooting instructions : BMW-5005
BOSCH system : Motronic M1.1
Make of vehicle : BMW
Basic microcard : PKW-052

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Structure, usage, safety and precautionary measures.....	03
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Self-diagnosis test table.....	05
Test specifications.....	11
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Installation position of components, notes on removal and installation.....	21

SPECIAL FEATURES

These trouble-shooting instructions, valid at the time of publication, apply to the following vehicle models:

*BMW 320i, 520i with 2.0 l / 6 cyl. as of 1.87
BMW 325i, 325iX with 2.5 l / 6 cyl. as of 1.87
BMW 325e, 525e with 2.7 l / 6 cyl. as of 1.87

*Motronic system M 1.1 with self-diagnosis and flashing-code output (55-pin plug).

*Control unit with variant coding.
Important!
The following details must be stated when ordering:

1. Part number, 10-digit as before
2. Growth number, 3-digit (001 to 999)
3. Variant control word, 4-digit alpha-numeric.

Example: 1. 0 261 200 152
2. 002
3. C05E

For further information, see basic instructions

*Control unit with integral holding circuit (for tank ventilation valve).

*One common sensor for engine speed and reference mark.

*Group injection: division into 2 groups which inject staggered with respect to time.
Group 1: cylinder 1,3,5.
Group 2: cylinder 2,4,6.
Recognition via sensor on high-voltage cable to cylinder 6.

*Adaptive lambda closed-loop control (catalytic converter).

*Tank ventilation with pulsed valve (if vehicle fitted with catalytic converter).

STRUCTURE, USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to various causes/component faults.

For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to prevent damage to the engine, trigger boxes and control units or to the ignition system, be sure to observe the information in the basic instructions.

CAUTION!

High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

* Avoid injection of fuel and high-voltage flashovers when testing the compression.
To ensure this, disconnect main relay.

TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Rough idling (engine speed, exhaust gas).
4. Poor throttle response, flat spot during acceleration.
5. Engine misfiring (ignition, fuel injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

											Cause (component fault)
*	*	*	*	*	*	*	*	*	*	*	Self-diagnosis
*											Voltage at control unit
*											Engine-speed/reference-mark sensor
*		*			*	*					Fuel pressure
*		*			*	*					Solenoid-operated injection valves
		*	*	*	*						Throttle-valve switch
	*	*	*	*	*	*					Air-flow sensor
	*	*	*	*							Idle actuator
*	*	*	*								Air-intake system
		*									Idle speed, CO
*		*		*	*						Ignition coil
*		*	*	*	*						Primary signal
		*	*	*	*	*					Secondary pattern
*	*	*	*		*	*		*	*		Ignition point
*			*								High-voltage sensor
		*									Overrun cut-off
		*	*	*							Interference-suppression resistors
		*	*	*							Noise test
					*						Interference
					*						Throttle valve
					*						Fuel delivery
	*	*	*				*				Tank vent
		*	*								Lambda closed-loop control
*	*	*	*	*	*	*	*	*	*	*	Control unit

SELF-DIAGNOSIS TEST TABLE

Fault indication Flashing code	Testing of component/function	Test instructions/Test conditions	Terminals	Set values
1 2 1 1	Control unit (memory contents)	Control unit defective.		—
1 2 1 5	Air-flow sensor	Test lead to term. 7 for open circuit, short circuit to ground or to positive (5 V or B+), and for contact with term. 12 and term. 26. Test leads to term. 12 and term. 26 for open circuit. Test resistances of air-flow sensor: between term. 26 and term. 7 (deflect air-flow sensor flap): between term. 26 and term. 12:	7,12,26	— 8...2500 Ω 500...1100 Ω
1 2 2 1	Lambda sensor	Break in lead to lambda sensor, short-circuited to ground or battery voltage. Watch for worn cable insulation! Sensor heater defective. Sensor clogged.	28	—
1 2 2 2	Lambda closed-loop control at rich or lean stop	Test CO content: Test intake system for leakages. Test fuel pressure: Injection valves defective.		0,2...1,2 %by vol
1 2 2 3	Coolant-temperature sensor	Check temperature sensor and lead for open circuit and short circuit to ground. Temperature-sensor resistance: at +15...+30°C : at approx. +80°C :	45	— 2,3...2,7 Ω 1450...3300 Ω

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Fault indication Flashing code	Testing of component/function	Test instructions/Test conditions	Terminals	Set values
1 2 2 4	Air-intake temperature sensor	Test temperature sensor and lead for open circuit and short circuit to ground. Temperature-sensor resistance at +15°C...+30°C:	44	— 1450...3300 Ω
1 2 3 1	Supply voltage for control unit with engine running	Supply voltage too low: Test voltage drops at positive and ground terminals. Charge battery. Supply voltage too high: Test alternator regulator.	37(+), 19(-)	Greater than 10 V Less than 16 V
1 2 3 2	Throttle-valve switch/idle contact	Fault: idle contact permanently closed. Idle contact closed in inoperated position: Actuate throttle valve slightly:	52	0 Ω Infinity Ω
1 2 3 3	Throttle-valve switch/full-load contact	Fault: full-load contact permanently closed. Full-load contact closed in full-load position: Release accelerator pedal slightly:	53	0 Ω Infinity Ω
1 2 5 1	Injection valves 1+3+5 and control unit (injection output stage)	Fault: short circuit to ground, to battery positive or break in common positive and negative lead. Test lead and valves 1+3+5 for short circuit and open circuit; if O.K., control unit defective.	16	4,8... 5,7 Ω (3 valves parallel) 14,5...17 Ω (1 injection valve)

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Fault indication Flashing code	Test of component/function	Test instructions/Test conditions	Terminals	Set values
1 2 5 2	Injection valves 2+4+6 and control unit (injection output stage)	Fault: short circuit to ground, to battery positive or open circuit in common positive and negative lead. Test lead and valves 2+4+6 for short circuit and open circuit; if O.K., control unit defective.	17	4,8...5,7 Ω (3 valves parallel) 14,5...17 Ω (1 injection valve)
1 2 6 2	Idle actuator and control unit (output stage)	Fault: short circuit to ground or to battery positive. Test leads for contact with ground or battery positive; if O.K., control unit defective. Winding resistances at +15...+30°C: between connection 1 and 2 : between connection 3 and 2 :	4, 22	19...25 Ω 17...22,5 Ω
1 2 6 3	Tank-ventilation valve and control unit (output stage) Note: CAT models only	Fault: short circuit to ground or to batt. +ve. Test lead for contact with ground or batt. +ve.; if O.K., control unit defective. Winding resistance at +15...+30°C:	5	35...55 Ω
1 2 7 8 *	Transmission action	Fault: short circuit to ground. Test lead for short circuit to ground or corresponding output in transmission control unit defective.	51	—
1 2 8 8	Fault lamp and control unit (lamp output stage)	Fault: short circuit to ground or to batt. +ve.	15	

* = Applies to vehicles with electronic transmission control

TEST SPECIFICATIONS

Pressure regulator			
Fuel pressure		2,0/2,7 l:	
2,3...2,7 bar		2,5 l:	
2,8...3,2 bar			
Electric fuel pump			
Fuel delivery			
measured in return line	at least	785 cm ³ /30s	
Pre-supply pump	at least	865 cm ³ /30s	
(if present)			
Supply voltage			
(under load):	at least	12 V	
Intake-air temperature sensor			
Internal electrical resistance			
measured at air-flow sensor			
between term.1 and term.4			
at ambient temperature			
(+15°C...+30°C):		1450...3300 Ω	
Coolant-temperature sensor			
Plug color, blue. Internal elec-			
trical resistance at			
ambient temperature			
(+ 15° C...+ 30° C):		1450...3300 Ω	
with engine at normal operating temp.			
(approx. + 80° C):		280...360 Ω	
Solenoid-operated injection valve			
Internal electrical resistance			
at ambient temperature			
(+ 15° C...+ 30° C):		14,5...17 Ω	
Air-flow sensor			
Internal electrical resistance between:			
term.2 and term.4 :		8...2500 Ω (*)	
term.3 and term.4 :		500...1100 Ω	

(*) Slowly deflect air-flow sensor flap as far as it will go. Resistance fluctuates between the terminals of the potentiometer.

TEST SPECIFICATIONS (CONTINUED)

Engine-speed/reference-mark sensor			
Internal electrical resistance			
between term.1 and term.2 at ambient			
temperature (+15°C...+30°C):		400...800 Ω	
Air gap:		0,8±0,5 mm	
Throttle-valve switch			
Resistance of idle contact			
(term.2 and term.18):		0 Ω	
Resistance of full-load contact			
(term.3 and term.18):		0 Ω	
Idle actuator			
Internal electrical resistance			
at +15°...+30°C between			
term.1 and term.2 :		19...25 Ω	
term.3 and term.2 :		17...22,5 Ω	
Lambda sensor			
Resistance of heater winding			
(sockets 3 and 4 in 4-pin terminal			
to lambda sensor):		1...15 Ω	
Ignition coil			
Primary resistance:		approx. 0,8 Ω	
Secondary resistance:		5000...7200 Ω	
Interference-suppression resistors			
High-voltage-distributor rotor:		1 k Ω	
High-voltage-distributor dome:	each	1 k Ω	
Spark-plug connector:	each	5 k Ω	
Spark plugs:		5 k Ω	
Ignition coil:		1 k Ω	

TEST SPECIFICATION (CONTINUED)

High-voltage sensor:

Internal electrical resistance
between term. 1 and term. 2:

Approx.

0 Ω

Tank-ventilation valve:

(in catalytic-converter vehicles only)

Internal electrical resistance at
ambient temperature (+15°C...+30°C):

35...55 Ω

Idle test:

engine at normal operating temperature,
switch off loads.

Idle speed:

760 \pm 40 min⁻¹

Spark-advance angle:

720 \pm 40° crankshaft

(automatic transmission to N or P)

CO content: without catalytic converter:

9 \pm 5 % CO by vol.

Adjust mixture at bypass screw in

air-flow sensor:

turning counterclockwise makes mixture leaner,

turning clockwise makes mixture richer.

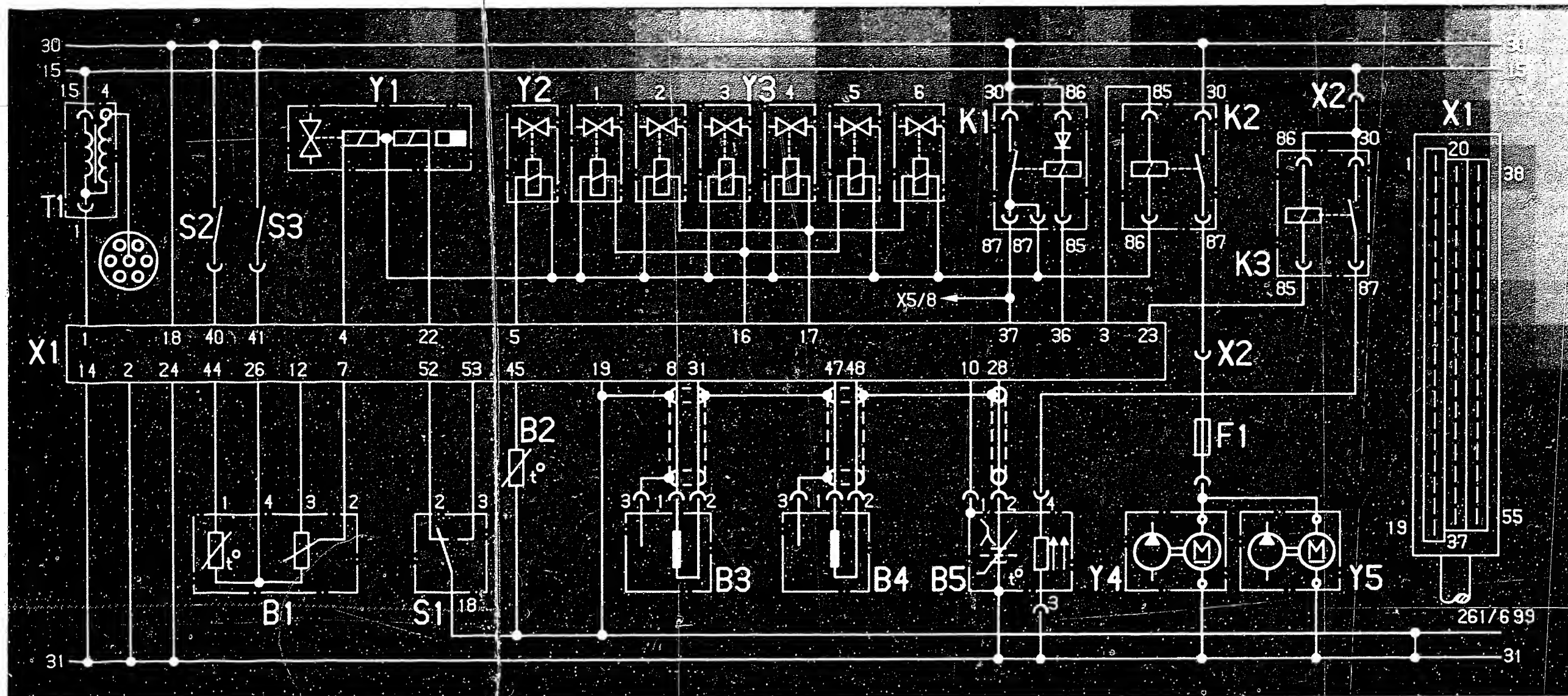
For production reasons:
continued on the following
coordinate.

Catalytic-converter vehicles:

1,0 \pm 0,5 % CO by vol.

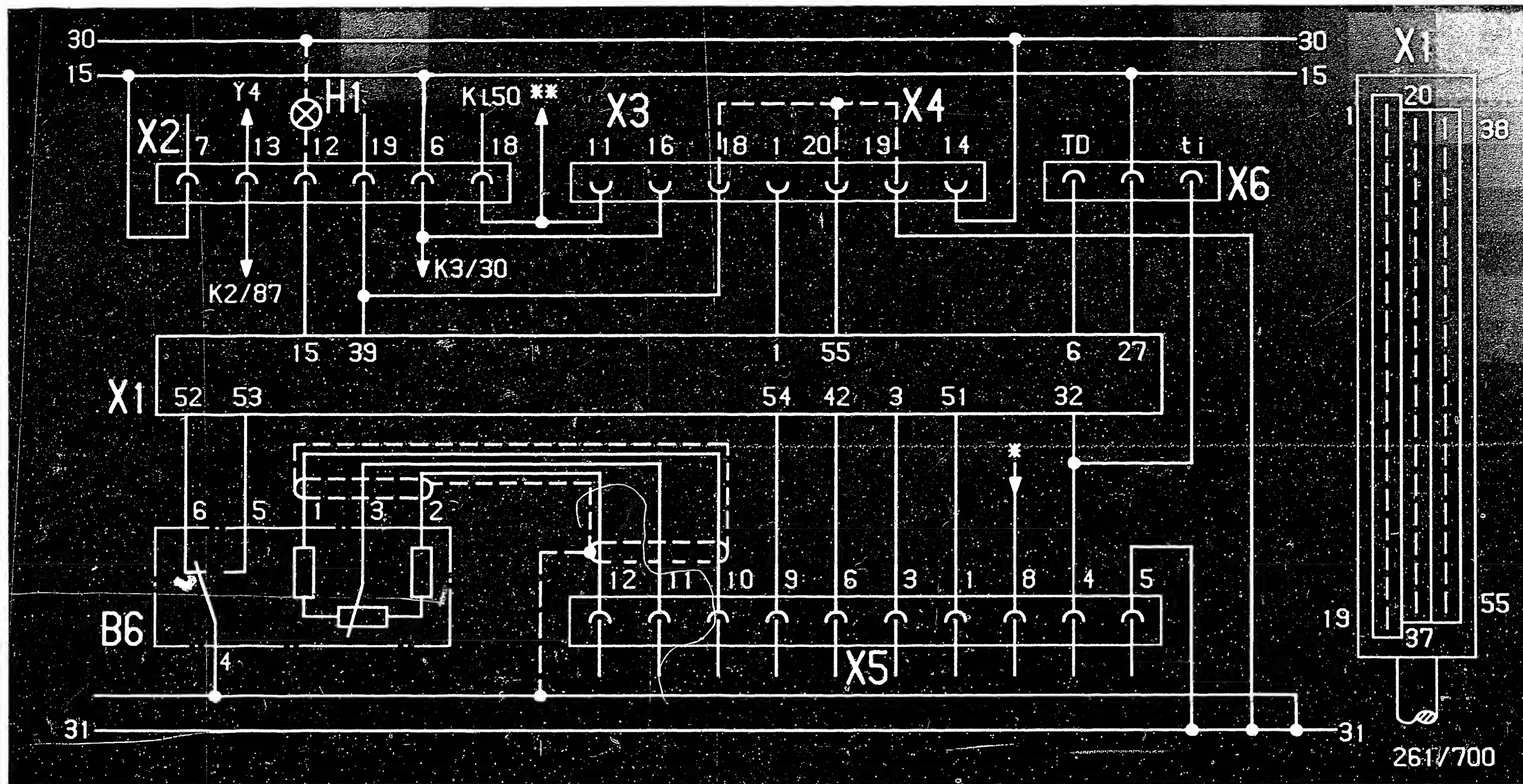
(Measure CO upstream of catalytic
converter if sample pickup is fitted,
pull apart lambda-sensor plug).

See equipment and Autodata microcards for
setting values for valve clearance and other
engine-related data.



ELECTRICAL TERMINAL DIAGRAM (3 and 5 Series)

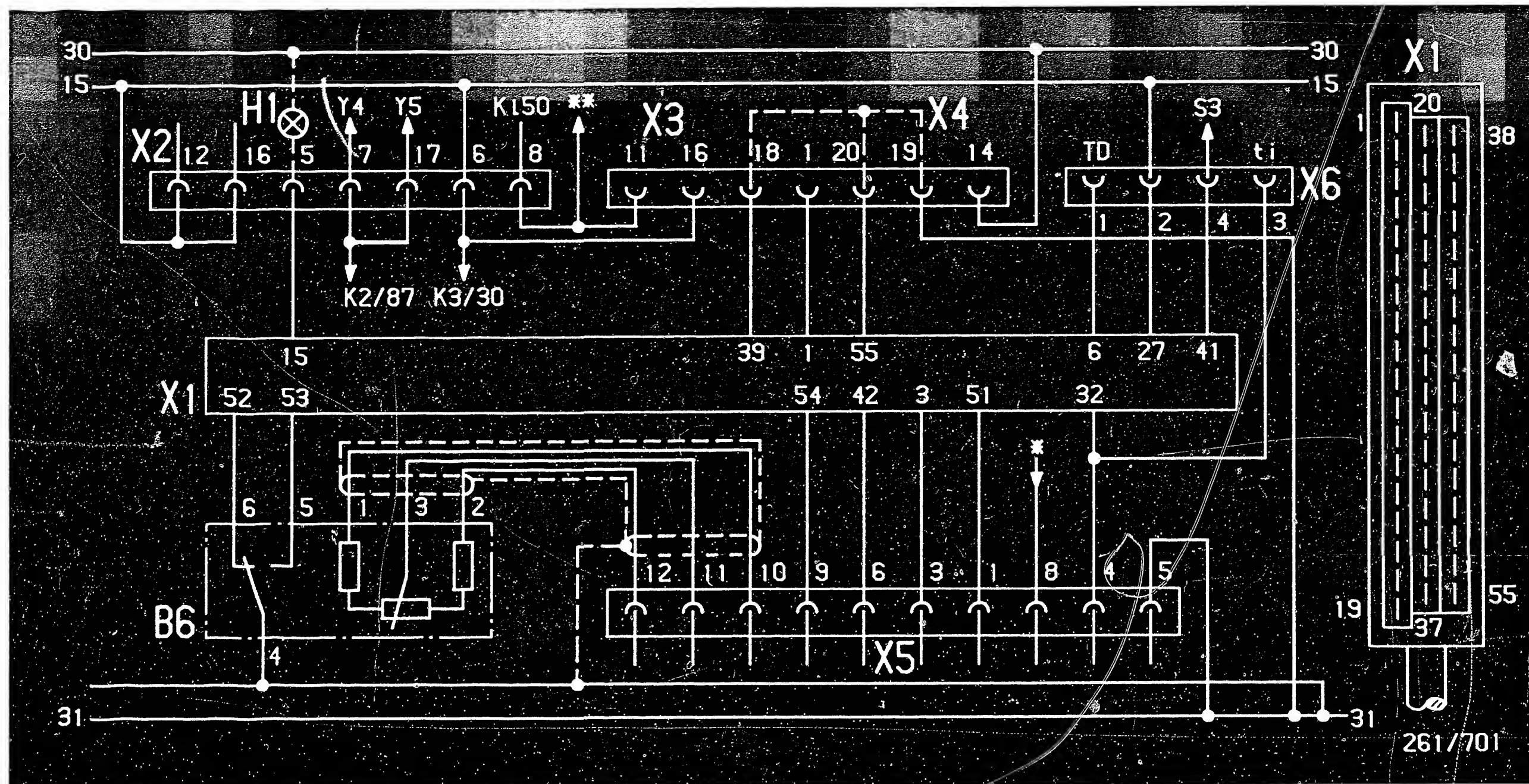
- | | | |
|--------------------------------------|--|--|
| B1 = Air-flow sensor | K2 = Pump relay | Y3 = Solenoid-operated injection valve |
| B2 = Coolant-temperature sensor | K3 = Sensor-heater relay (cat only) | Y4 = Electric fuel pump |
| B3 = High-voltage sensor | S1 = Throttle-valve switch | Y5 = Pre-supply pump (if present). |
| B4 = Eng.-speed/ref.-mark sensor | S2 = Switch on air-cond. compr. | |
| B5 = Heated lambda sensor (cat only) | S3 = Switch on air-conditioner | |
| F1 = Pump fuse | T1 = Ignition coil | |
| 3 Series : No.11 | X1 = Motronic control-unit plug | |
| 5 Series : No.1 | Y1 = Idle actuator | |
| K1 = Main relay | Y2 = Tank ventilation valve (cat only) | |



ELECTRICAL TERMINAL DIAGRAM (continued, 3 Series)

B6 = Throttle-valve switch with pot
(with electro. transm. control for Item S1)
H1 = "CARB" lamp (fault lamp; US version)
X1 = Motronic control-unit plug
X2 = Engine plug (20-pin)

X3 = Diagnostic plug (20-pin)
X4 = Jumper in diagnostic-plug cover
X5 = 13-pin plug to transmission control unit
X6 = 3-pin connector
* = from main relay term.87(+)
** = to starting motor term.50

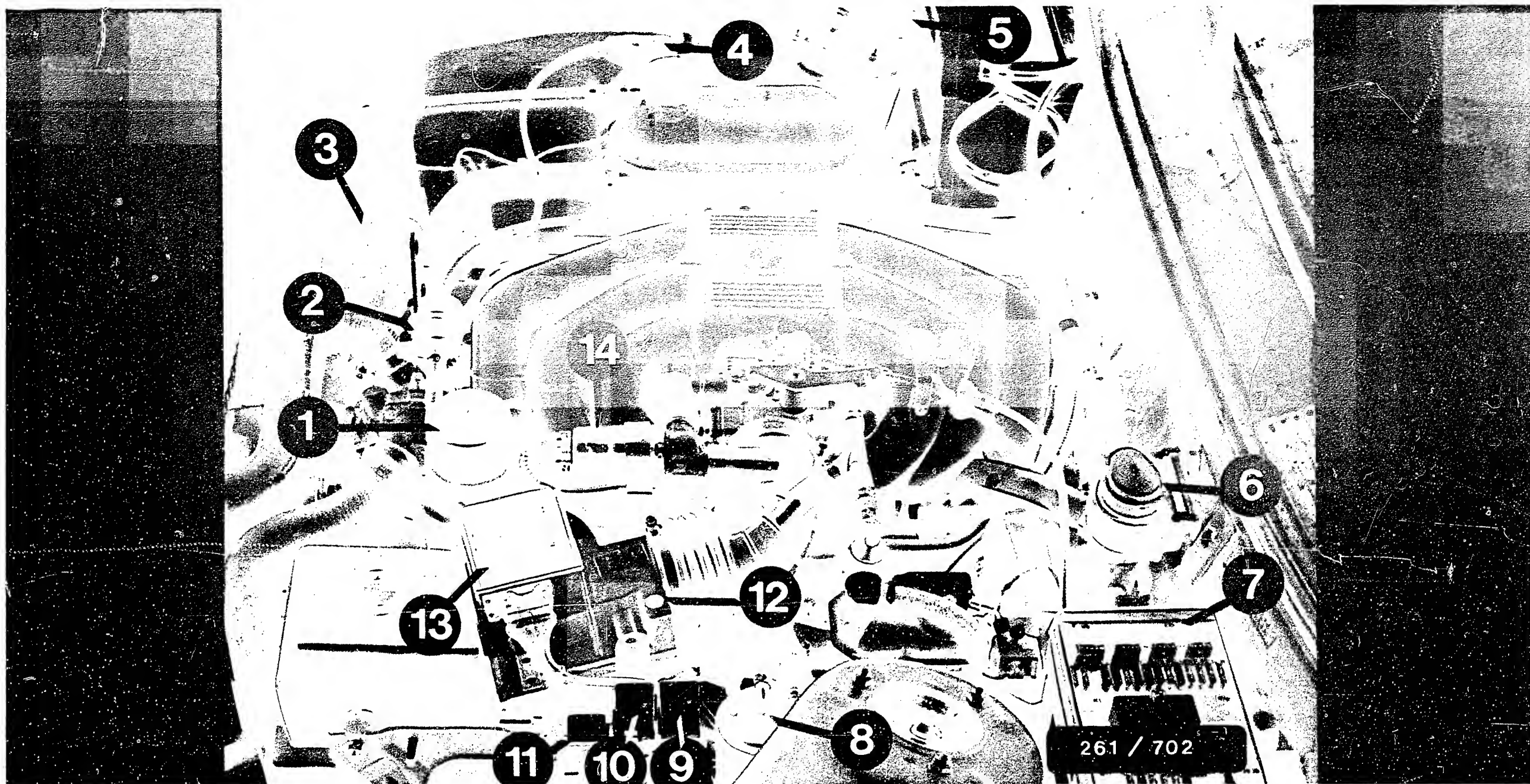


ELECTRICAL TERMINAL DIAGRAM (continued, 5 Series)

B6 = Throttle-valve switch with pot
 (with electro. transm. control for item S1)
 H1 = "CARB" lamp (fault lamp; US version)
 X1 = Motronic control-unit plug
 X2 = Engine plug (20-pin)
 X3 = Diagnostic plug (20-pin)

X4 = Jumper in diagnostic-plug cover
 X5 = 13-pin plug to transmission control unit
 X6 = 6-pin connector

* = from main relay term.87(+)
 ** = to starting motor term.50



INSTALLATION POSITION OF COMPONENTS (3201)

- | | |
|------------------------------|---|
| 1 = Diagnostic socket | 7 = Fuse box |
| 2 = Fuel-pressure regulator | 8 = Active carbon canister (cat only) |
| 3 = High-voltage distributor | 9 = Sensor-heater relay (color: orange) |
| 4 = Ignition coil | 10 = Pump relay (color: orange) |
| 5 = Motronic ground terminal | 11 = Main relay (color: white) |
| 6 = Engine plug | 12 = CO adjusting screw |

- | |
|----------------------|
| 13 = Air-flow sensor |
| 14 = Idle actuator |

INSTALLATION POSITION OF COMPONENTS (Continued)

The indications "right" and "left" always refer to the forward direction of travel.

Control unit:

In the glove compartment above the cover (upper illustration, arrow).

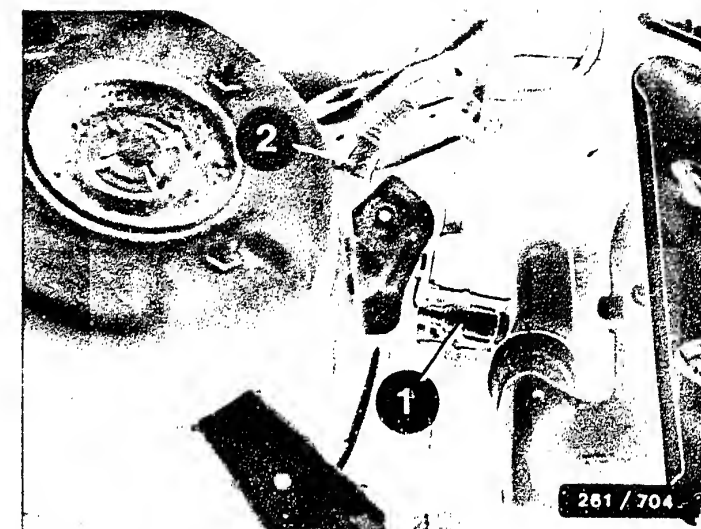
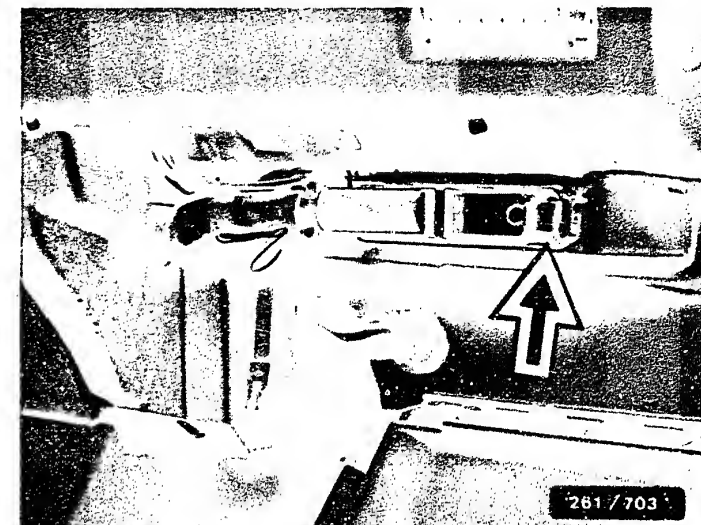
Lambda sensor:

In the common exhaust pipe (center illustration, Item 1).

Plug-in connection to lambda sensor (pin-type, 4-pin):
beneath the battery (center illustration, Item 2).

Tank-ventilation valve:

In the engine compartment beneath the throttle-valve assembly
(lower illustration, arrow).



INSTALLATION POSITION OF COMPONENTS (Continued)

Engine-speed/reference-mark sensor:

At the front of the engine to the right of the crankshaft ring gear (upper illustration, arrow).

Plug-in connection to engine-speed/reference-mark sensor:

Near to the oil dipstick (lower illustration, Item 2).

High-voltage sensor:

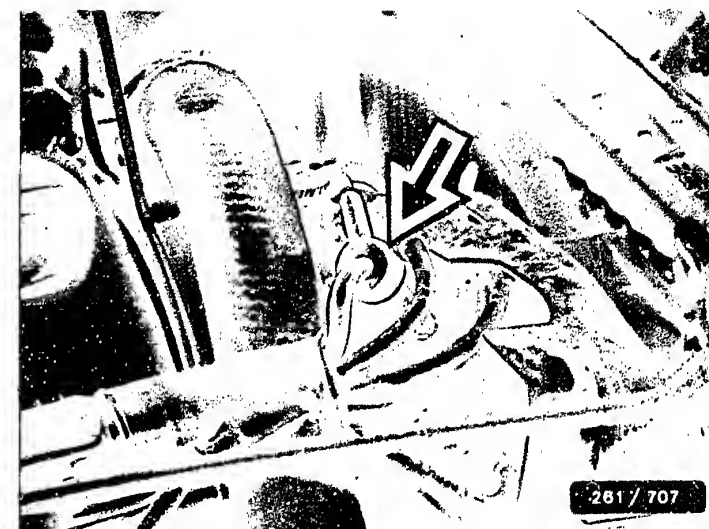
On H.T. lead to cylinder 6 (center illustration, arrow).

Plug-in connection to high-voltage sensor:

Near to the oil dipstick (lower illustration, Item 1).

Air-temperature sensor:

In the air-flow sensor.



INSTALLATION POSITION OF COMPONENTS (Continued)

Electric fuel pump:
Beneath the vehicle (upper illustration, item 1).

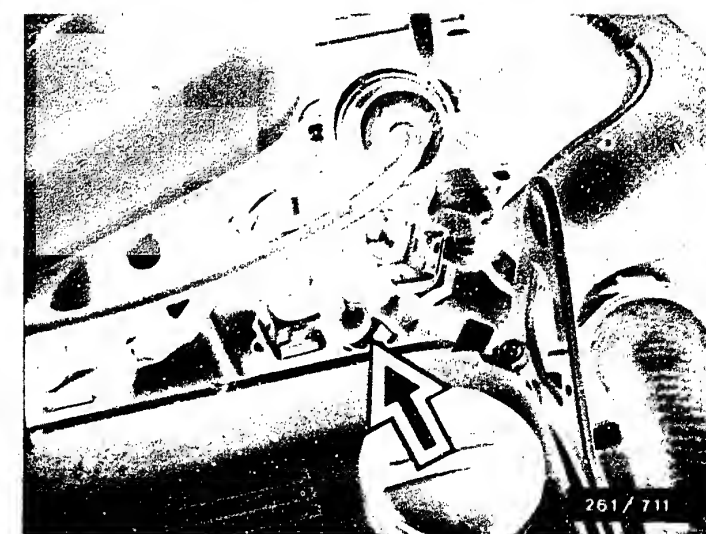
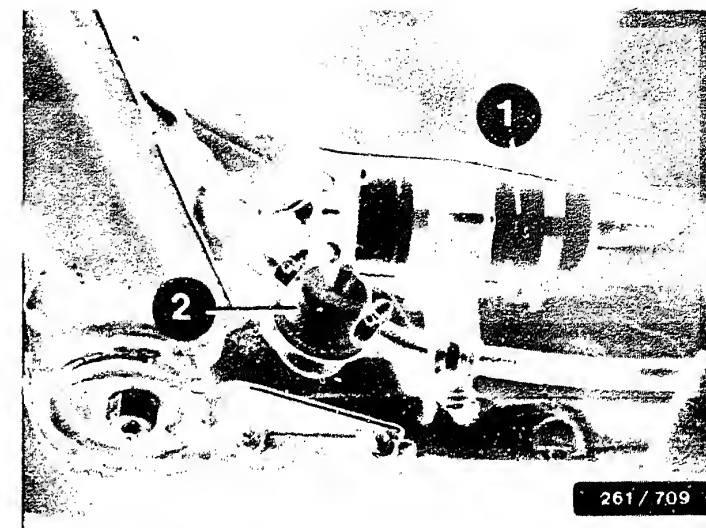
Fuse No. 11 for electric fuel pump:
In the fuse box on the firewall at the left.

Fuel-pressure damper:
Beneath the vehicle (upper illustration, item 2).

Fuel filter:
In the engine compartment on the left, near to the
firewall (center illustration, arrow).

Coolant-temperature sensor:
next to injection valve 1 (lower illustration, arrow).

Throttle-valve switch:
On the throttle-valve assembly at the bottom.



Trouble-shooting instructions : FIA-5000
BOSCH system : Mono-Jetronic
Make of vehicle : FIAT
Basic microcard : PKW-053

TABLE OF CONTENTS

Section	Coordinates
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Structure, usage.....	04
Safety and precautionary measures.....	04
Trouble-shooting chart.....	05
Rapid diagnosis chart.....	07
Test specifications.....	13
Electrical terminal diagram.....	17
Assignment of plugs of injection unit	
Installation position of components.....	21

SPECIAL FEATURES

These brief instructions, valid at the time of publication, apply to the following vehicles with 1.499/4 cyl. engine.

FIAT Regata 75 i.e EU 04.87->
Ritmo 75 i.e
Uno 75 i.e

- * Mono-Jetronic with 25-pin control unit:
0 280 000 706
Activated by term. 1 of the ignition coil
- * Electric fuel pump is activated by means of a pump relay.
- * Load detection by throttle-valve potentiometer via the opening angle of the throttle valve.
- * Throttle-valve idle actuator with idle contact for low-idle-speed control.
- * Plausibility, i.e. if sensors are defective, a substitute value is made available by the control unit. This applies to the following sensors: engine-temperature sensor, intake-air temperature sensor, idle switch and full-load switch.
- * Adaptive lambda closed-loop control and lambda sensor
- * For testing the fuel pressure, use pressure gauge KDJE-P100/17 and hose lines of the pressure-measuring instrument.
- * Connect 3-way line KDJE-P 100/13 between fuel-inlet line and throttle-body injection unit.

SPECIAL FEATURES (Continued)

Observe the following points in order to avoid damage to the throttle-body injection unit.

- * Do not loosen the pressure-regulator screws. Do not apply pressure to the upper section, since this changes the fuel pressure.
- * Do not turn the stop screw (? stop) of the throttle valve. The screw has a fixed setting and is safe-guarded against being turned.
- * Do not actuate idle contact if throttle valve is deflected (part-load and full-load ranges). This could otherwise lead to throttle-vlv.idle actuator locking.
- * Do not adjust the idle-speed adjusting screw (at bottom of throttle-plate lever). The coordination of throttle plate and idle actuator is otherwise no longer guaranteed.
- * Do not adjust throttle-valve potentiometer. It is not possible for the After-Sales Service to test the coordination of the throttle-valve position (angle) to the potentiometer.

STRUCTURE, USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to various causes/component faults.

For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

Identical test-step numbering makes it easier to find individual test steps in the brief and basic instructions.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to prevent damage to the engine, trigger boxes and control units or to the ignition system, be sure to observe the information in the basic instructions.

CAUTION!

High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

- * Avoid injection of fuel when testing the compression.
To ensure this, disconnect pump relay.

For further precautionary measures, see brief instructions.

TROUBLE-SHOOTING CHART

Customer complaint (symptom of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Rough idling (engine speed, exhaust gas).
4. Poor throttle response, flat spot during acceleration.
5. Engine misfiring (ignition, injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

								Cause (Component fault)
*	*	*	*	*	*	*	*	Universal test adapter
*	*	*	*		*			Air-intake system
				*	*			Fuel quantity
*	*	*	*		*	*	*	Fuel pressure, leakage
		*		*	*	*	*	Solenoid-operated injection valve
				*				Alternator, interference suppression
*	*	*			*			Starting control
				*	*			Overrun cut-off
		*	*	*		*		Engine-speed adjustment, CO-adjustment
		*	*	*		*		Lambda closed-loop control
					*			Exhaust-gas catalytic converter
		*	*			*		Tank vent

For production reasons:
continued on the following
coordinate.

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01
 Adapter lead: 1 684 463 170

Test step	Switch V	Ω	Termi- nals	Testing of component/function	Test instructions/ Test conditions	Set values
1	5	-	1 - 5 (+) (-)	Term. 1 signal from ignition coil term. 1	Transmission in neutral, start	Ignition pulses on oscilloscope
2	6	-	4 - 5 (+) (-)	Voltage supply of control unit		8...15 V
3	7	-	9 - 5 (+) (-)	Main relay	Switch on ignition	8...15 V
4	8	-	17 - 5 (+) (-)	Simulation, actuation of electric fuel pump	Switch on ignition Press push-button 3	Electric fuel pump running, check by listening
5	8	-	17 - 5 (+) (-)	Pump relay	Switch on ignition	8...15 V
6	-	-	-	Not applicable		
7	-	-	-	Not applicable		
8	12	-	12 - 5 (+) (-)	Tank ventilation valve (if present)	Switch on ignition Press push-button 4	Tanke ventilation valve must pick up, check by listening.
9	-	-	-	Not applicable		

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 18.01 (Continued)
 Adapter lead: 1 684 463 170

Test step	Switch V	Ω	Termi- nals	Testing of component/function	Test instructions/ Test conditions	Set values
10	—	—	—	Not applicable		
11	 V	7	3 - 5	Throttle-valve-actuator idle contact	Disconnect plug from ignition control unit Throttle valve closed Throttle valve open	0...10 Ω infinity Ω
12	—	—	—	Not applicable		
13	—	—	—	Not applicable		
14	—	—	—	Not applicable		
15	 V	11	14 - 5	Temperature sensor (intake air)	Connect plug to ignition control unit. +15...30 °C :	1.45...3.3 k Ω
16	 V	12	2 - 5	Temperature sensor (engine)	+15...30 °C : approx. +80 °C :	1.45...3.3 k Ω 280...360 Ω
17	 V	13	25 - 5	Ground output stage		0...10 Ω
18	 V	14	13 - 5	Solenoid-operated in- jection valve		6...11 Ω

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (Continued)

Adapter lead: 1 684 463 170

Test step	Switch		Termi- nals	Testing of component/function	Test instructions/ Test conditions	Set values
	V	Ω				
19	 V	15	8 - 5	Throttle-valve potentiometer		600...1300 Ω
20	 V	16	7 - 18	Throttle-valve potentiometer	Deflect throttle valve (maximum at part load)	400...4000 Ω
21	 V	20	23 - 24	Throttle-valve idle actuator		Less than 250 Ω

TEST SPECIFICATIONS

Component/function

Set values

Electric fuel pump

- * Fuel delivery at return line: at least 600 cm³ /30s
- * Supply voltage under load: at least 12 V

Pressure regulator

- * Fuel pressure with engine not running: see chart

Solenoid-operated injection valve

- * Internal electrical resistance between term. 2 and term. 3 at ambient temperature +15...+30 °C : 1,0...1,6 Ω
- * Leakage after 60 s: Max. one drop may fall

Throttle-valve potentiometer

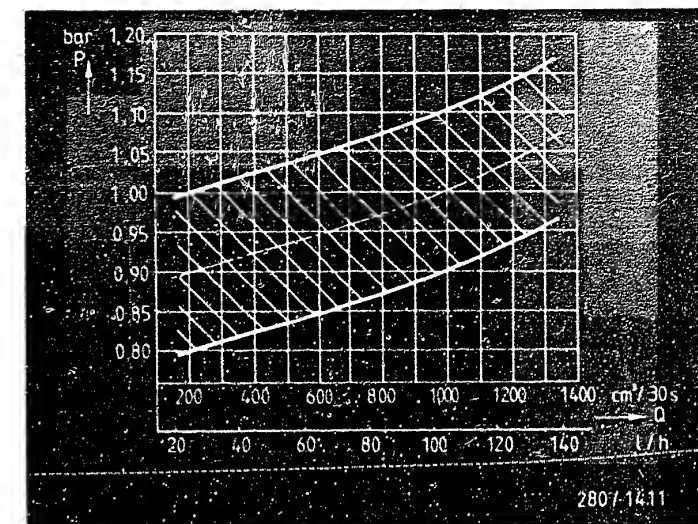
- * Resistance value between term. 5 and term. 1 : 600...1300 Ω
- term. 4 and term. 2 : 400...4000 Ω
- Deflect throttle valve (maximum at part load)

Throttle-valve idle actuator

- * Resistance value between term. 1 und term. 2 : less than 250 Ω

Lambda-sensor heating

- * Internal electrical resistance (PTC): 1...15 Ω



Q = Fuel delivery of electric fuel pump
p = Primary pressure

Test specifications (Continued)

Component/function	Set values
--------------------	------------

Temperature sensor (engine)

* Internal electrical resistance at ambient temperature +15...+30 °C :	1,45...3,3 k Ω
with engine at norm. op. temp. approx. +80 °C :	280...360 Ω

Temperature sensor (intake air)

* Internal electrical resistance between term.1 and term. 4 at ambient temperature +15...+30 °C :	1,45...3,3 k Ω
with engine at norm. op. temp. approx. +80 °C :	280...360 Ω

Tank ventilation valve

* Internal electrical resistance at ambient temperature +15...+30 °C :	35...55 Ω
--	-----------

Starting control

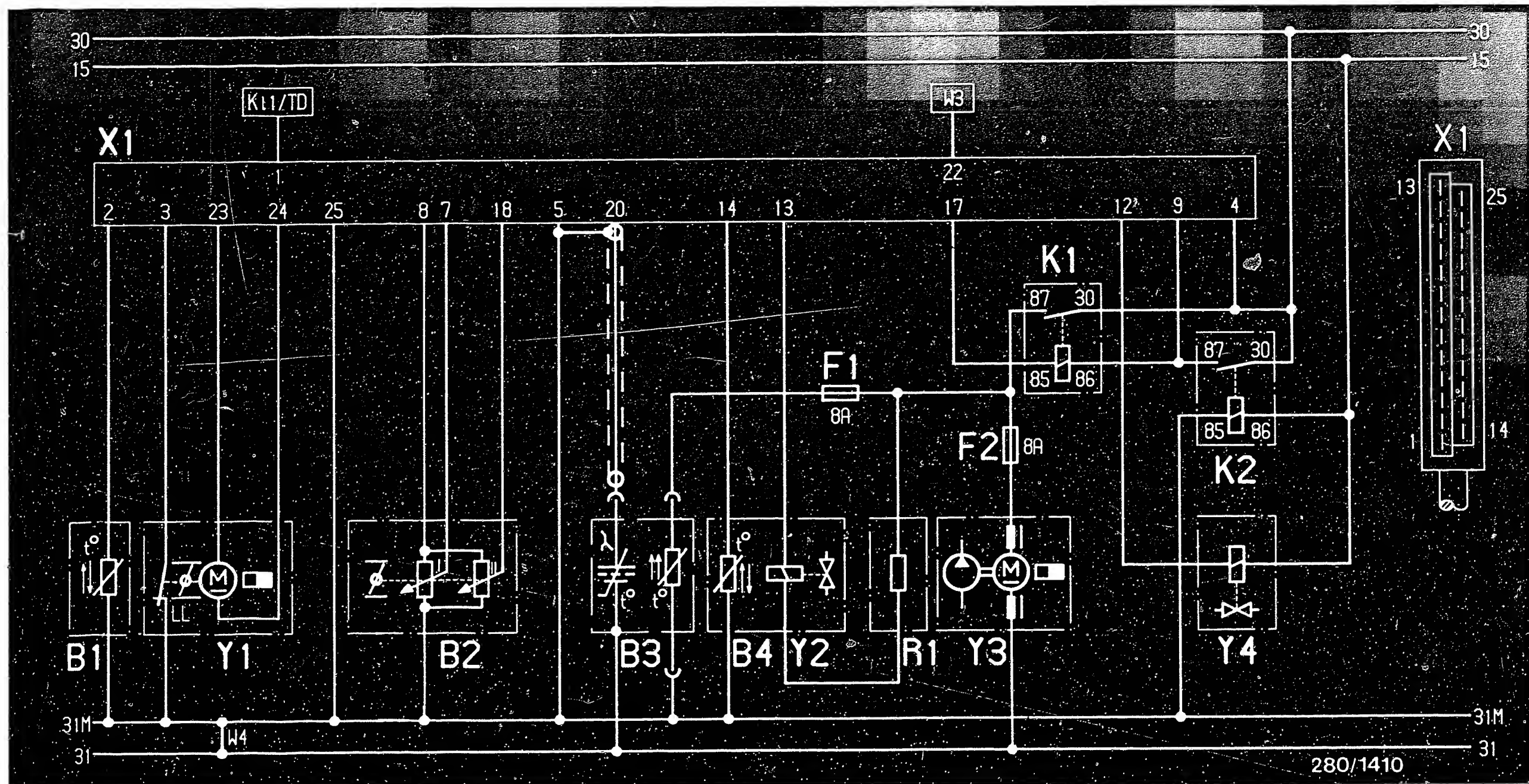
*Voltage at injection valve at start of cranking	approx. 1,0 V
after approx. 15s:	approx. 0,3 V

Idle adjustment

Engine at norm. op. temp., approx. +80°C	
* Idle speed:	800...900 min ⁻¹

See the equipment and Autodata microcards for the setting values for ignition, valve clearance and other engine-related data.

For production reasons:
continued on the following
coordinate.

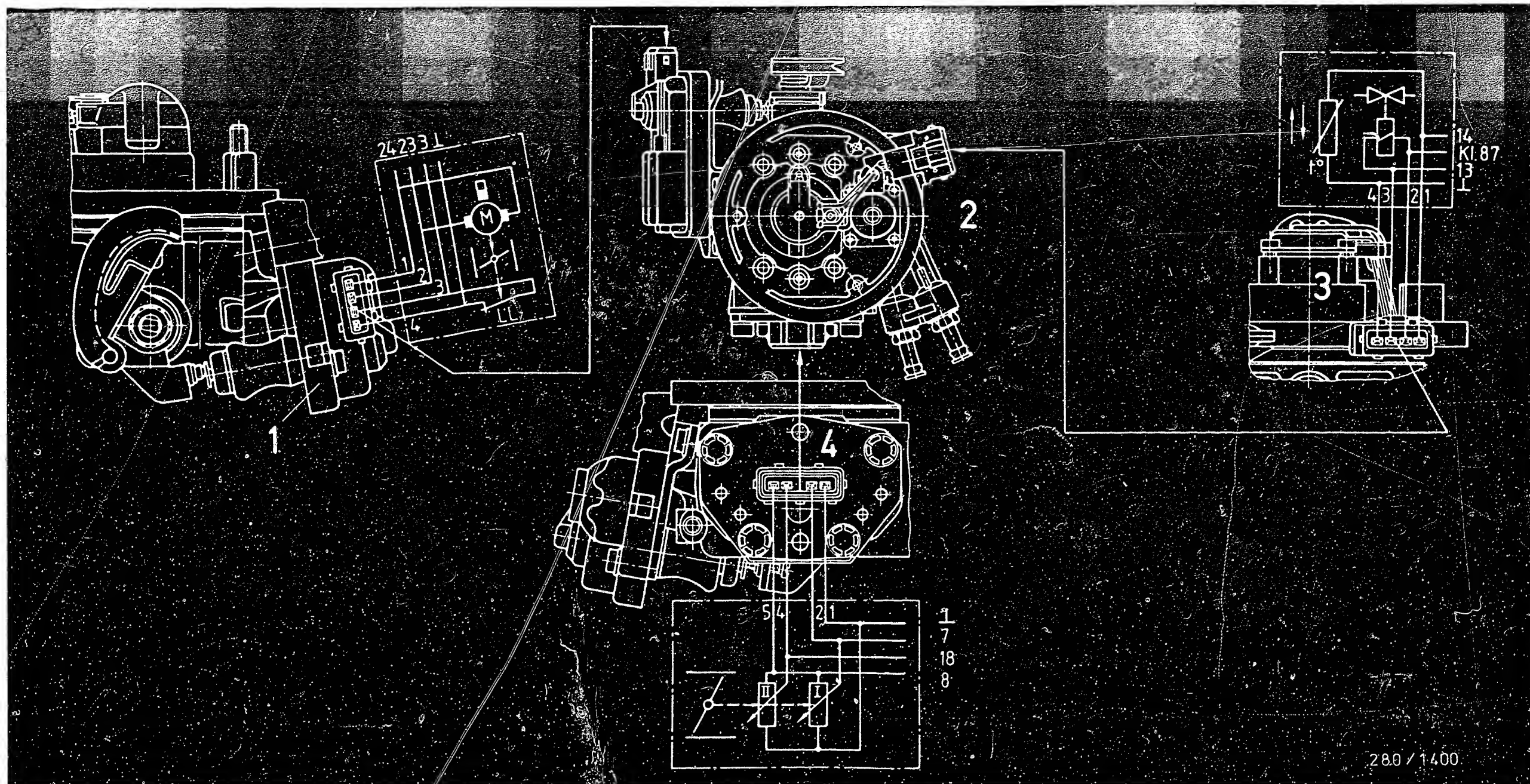


ELECTRICAL TERMINAL DIAGRAM

B1 = Temperature sensor (engine)
 B2 = Throttle-valve potentiometer
 B3 = Lambda sensor (heated)
 B4 = Temperature sensor (intake air)
 F1 = Fuse (sensor heating)

F2 = Fuse (electric fuel pump)
 K1 = Pump relay
 K2 = Main relay
 R1 = Series resistor
 W3 = Diagnosis

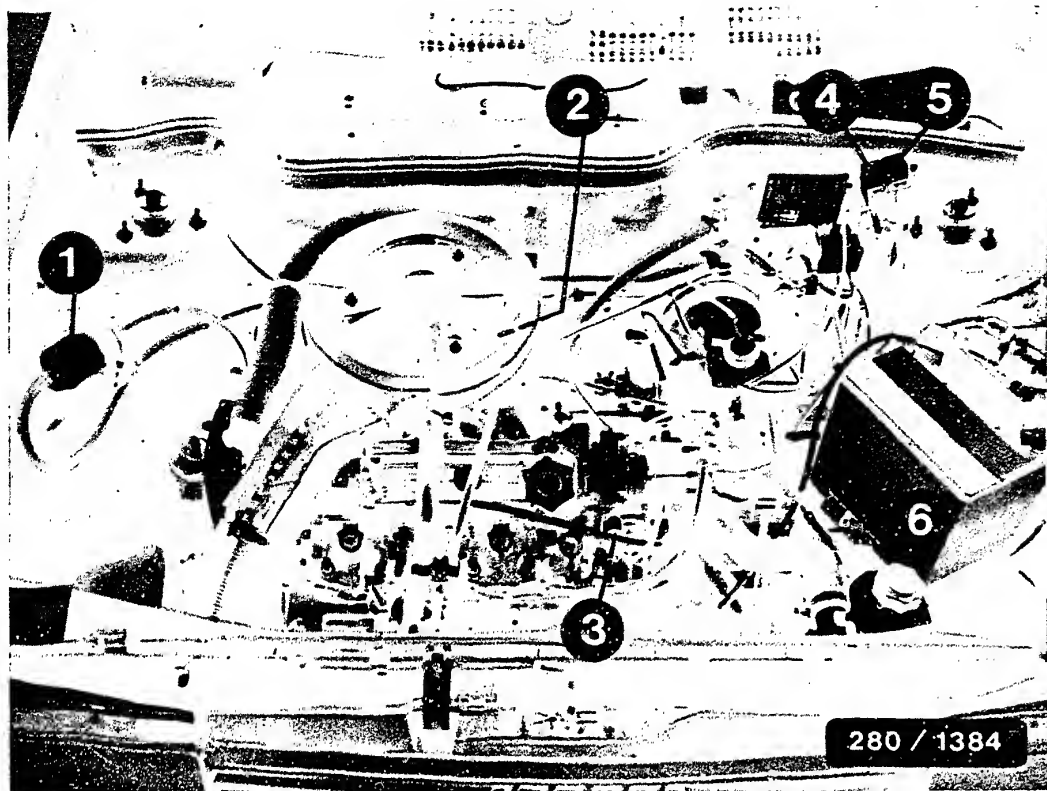
W4 = Ground strap, engine
 X1 = Control-unit plug
 Y1 = Idle actuator
 Y2 = Solen. op. injec. vlv.
 Y3 = Electric fuel pump
 Y4 = Tank ventilation valve (if present)



ASSIGNMENT OF PLUGS ON THROTTLE-BODY INJECTION UNIT

1 = Throttle-valve idle actuator with
idle contact
2 = Throttle-body injection unit

3 = Solenoid-operated injection valve and
temperature sensor (intake air)
4 = Throttle-valve potentiometer

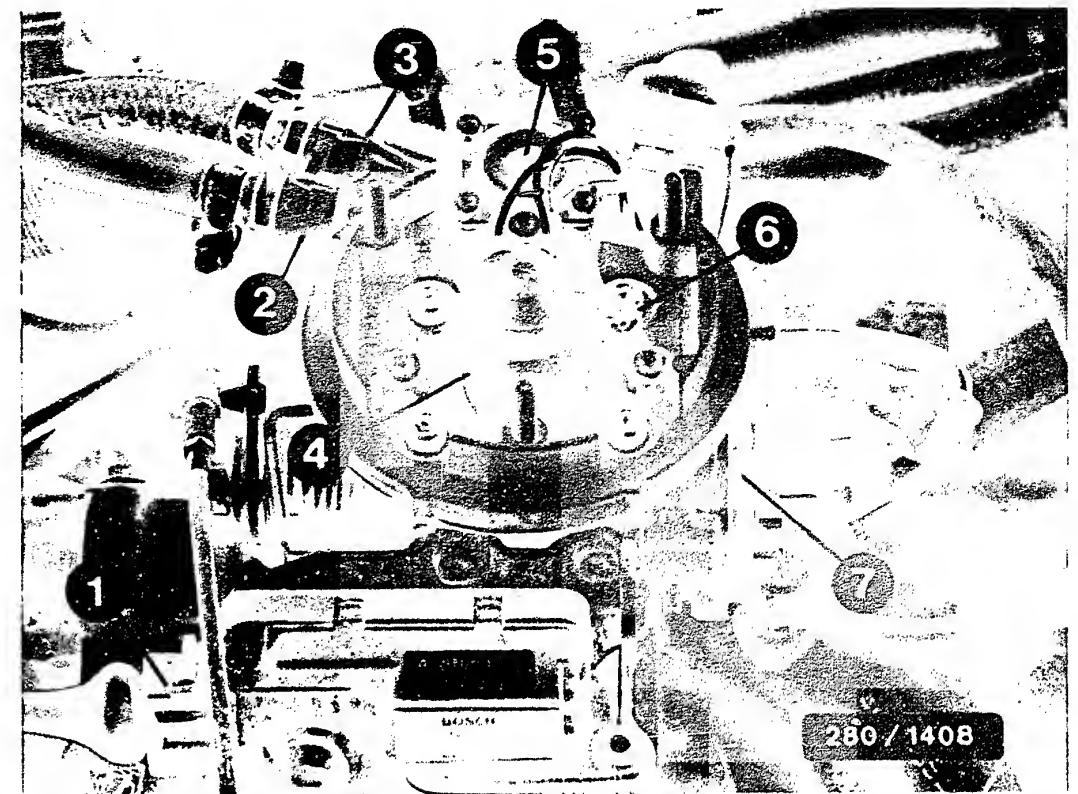


- 1 = Fuel filter
- 2 = Throttle-body injection unit
- 3 = Temperature sensor (engine)
- 4 = Main relay
- 5 = Pump relay
- 6 = Series resistor

INSTALLATION POSITION OF COMPONENTS

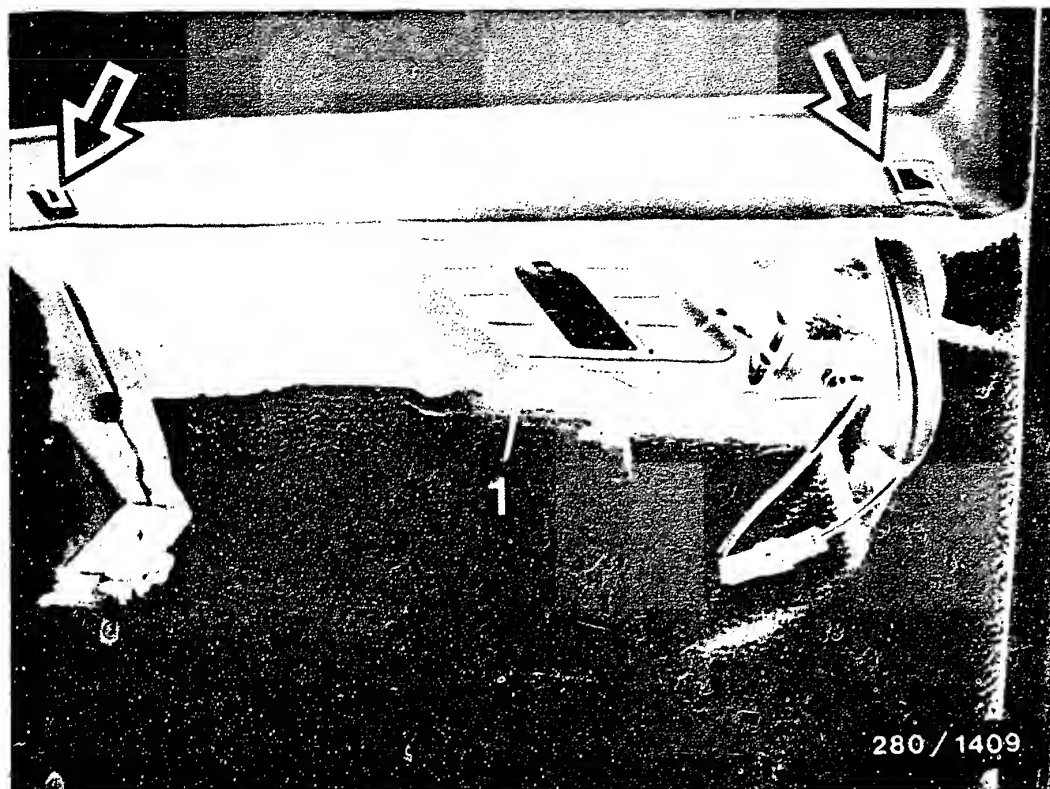
All details of installation positions are as viewed in the direction of travel.

Arrangement of components in the engine compartment.



INSTALLATION POSITION OF COMPONENTS (Continued)

- 1 = Throttle-valve idle actuator
- 2 = Fuel return
- 3 = Fuel inlet
- 4 = Solenoid-operated injection valve
- 5 = Pressure regulator
- 6 = Intake-air temperature sensor
- 7 = Throttle-valve potentiometer



INSTALLATION POSITION OF COMPONENTS (Continued)

1 = Control unit

The control unit is accommodated in the footwell on the passenger side.

To do this, loosen the screws of the cover (arrows) and remove cover.

Further installation positions

The electric fuel pump, with "in-tank" design, is combined with the tank indicator and access may be gained to it via a catch (beneath the rear seat bench) above the fuel tank.

The lambda sensor is bolted into the exhaust pipe in front of the catalytic converter.

For production reasons:
continued on the following
coordinate.

Trouble-shooting instructions : BMW-5006

BOSCH system : Motronic ML 3.1

Make of vehicle : BMW

Basic microcard : BMW-509 / Cat : BMW-512

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SPECIAL FEATURES

These trouble-shooting instructions, valid at the time of publication, apply to the following vehicle models:

- *BMW M3 with 2.3 l /4-cyl./4 valve as of 8.86
BMW M3 Cat as of 11.86
- *Motronic system ML 3.1 (35-pin plug).
- *One control unit (0 261 200 071) for cat/non-cat/US version with variant coding via term. 10 and term. 28 (see table).
- *Idle-mixture control
- *Altitude compensation
- *Lambda closed-loop control with integrator output at term. 12, if cat (measuring output, diagnostic socket outlet, socket 5).
- *Tank ventilation with activated carbon canister, relay (K2) and on/off valve (Y3), (vehicles with catalytic converter only).
- *Coding via term. 10 and term. 28 :

— — — Terms. Fuel — — —	Term. 10	Term. 28
Unleaded prem- ium (USA)	To ground	Open
Unleaded prem- ium (95 RON)	Open	To ground
Unleaded regu- lar (91 RON)	Open	Open
Leaded prem- ium (98 RON)	To ground	To ground

STRUCTURE, USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to various causes/component faults.

For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to prevent damage to the engine, trigger boxes and control units or to the ignition system, be sure to observe the information in the basic instructions.

CAUTION!

High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

* Avoid injection of fuel and high-voltage flashovers when testing the compression.
To ensure this, disconnect main relay.

TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Rough idling (idle speed, exhaust gas).
4. Poor throttle response, flat spot during acceleration.
5. Engine misfiring (ignition, injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

											Cause (component fault)
*											Voltage at control unit
*			*								Engine-speed/reference-mark sensor
*	*		*	*							Fuel pressure
			*	*							Fuel delivery
*	*			*	*						Solenoid-operated injection valve
	*		*								Throttle valve
	*	*	*								Throttle-valve switch
	*										Overrun cut-off
	*	*	*								Idle actuator
	*										Idle speed, CO
*	*	*	*								Air-intake system
*	*	*	*	*	*	*					Air-flow sensor
				*	*						Intake-air temperature sensor
*	*	*	*	*	*	*					Coolant-temperature sensor
*	*	*	*	*	*						Ignition coil
*	*	*	*	*	*						Primary signal
	*	*	*	*	*	*					Secondary pattern
*	*	*	*	*	*	*	*	*	*	*	Spark advance
	*	*	*	*							Interference-suppression resistors
			*	*							Interference
	*	*	*			*					Tank ventilation
	*	*									Lambda closed-loop control
						*	*				Control-unit coding (term. 10, 28)
*	*	*	*	*	*	*	*	*	*	*	Control unit

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01

Adapter lead: without cat 1 684 463 124/with cat 1 684 463 128

Note: lead...124 may be used as replacement for cat models, however, operational tests of lambda closed-loop control must be carried out in addition (without universal adapter).

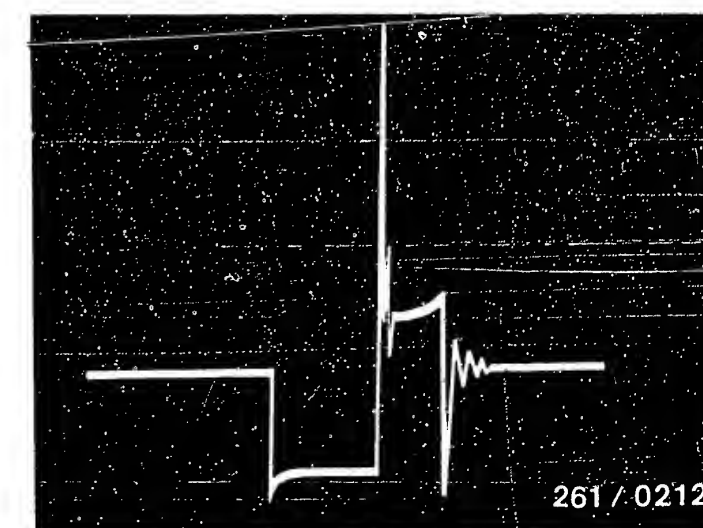
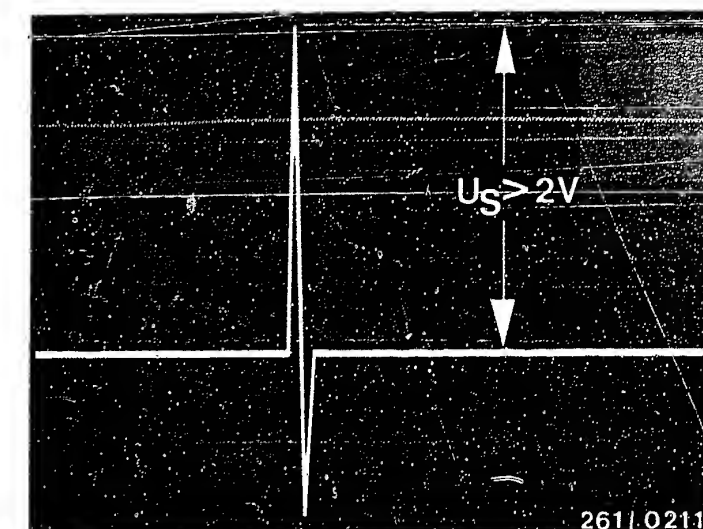
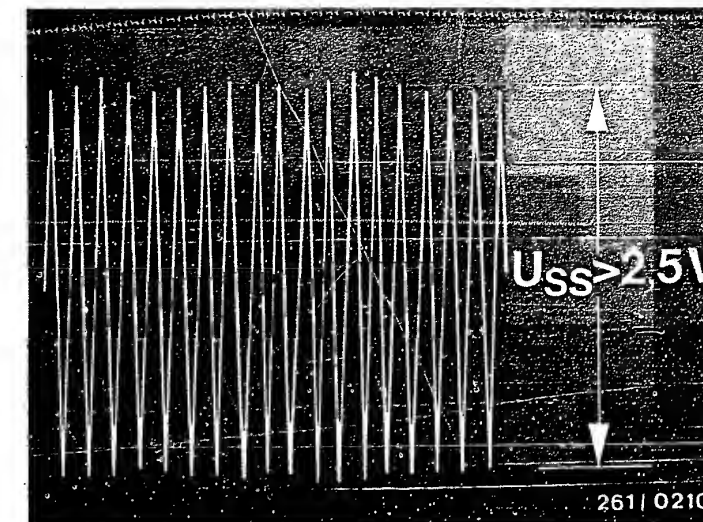
In this case, test steps 39,40,41, and 42 must be carried out manually, i.e. disconnect lambda-sensor plug and apply end on control-unit side (term. 24) to ground for rich stop/to positive pole of a 1.5 V monocr cell for lean stop (connect negative pole of monocr cell to ground).

Test	step	Switch	Terms.	Testing of component/function	Test instructions/ Test conditions	Set values	
		V	Ω				
1		 V	1	8, 5	Engine-speed sensor (insulation resistance)	Shift into neutral. Ignition off. Disconnect control unit and main relay.	Greater than 1 M Ω
2		 V	2	25, 5	Reference-mark sensor (insulation resistance)	—	Greater than 1 M Ω
3		 V	3	8, 27	Engine-speed sensor (winding resistance)	—	600...1600 Ω
4		 V	4	25, 26	Reference-mark sensor (winding resistance)	—	600...1600 Ω
5		 V	5	13, 5	Coolant-temperature sensor	Resistance temperature-dependent: (15°C...30°C) ; (80°C) ;	1450...3300 Ω 280... 360 Ω
6		 V	6	22, 5	Intake-air temperature sensor	Resistance temperature-dependent: (15°C...30°C) ;	1450...3300 Ω
7		 V	7	10, 5	Switch-over of fuel variants	Dependent upon coding:	Less than 10 Ω Greater than 1 M Ω
8		 V	8	29, 5	Not applicable		
9		 V	9	2, 5	Throttle-valve switch (idle contact)	Accelerator pedal in idle position: Slightly depress accelerator pedal:	Less than 10 Ω Greater than 1 M Ω
10		 V	10	3, 5	Throttle-valve switch (full-load contact)	Fully depress accelerator pedal: Slightly release accelerator pedal:	Less than 10 Ω Greater than 1 M Ω
11		 V	11 12 13	16, 5 17, 5 19, 5	Ground cables	Contact resistances:	Each less than 10 Ω

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01

Adapter lead: without cat 1 684 463 124 / with cat 1 684 463 128

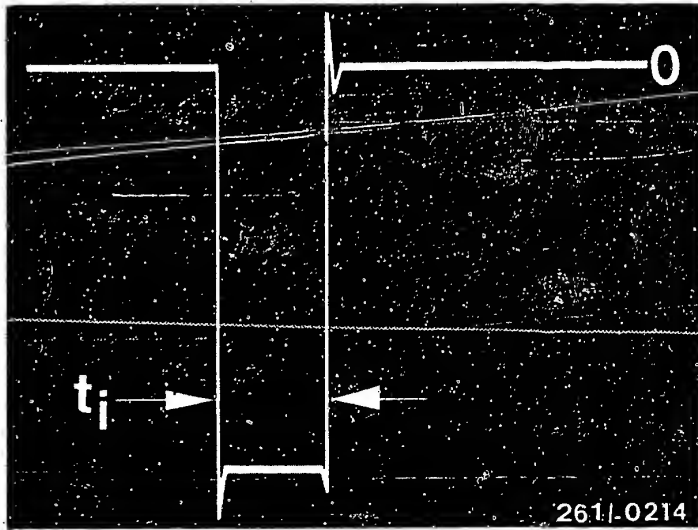
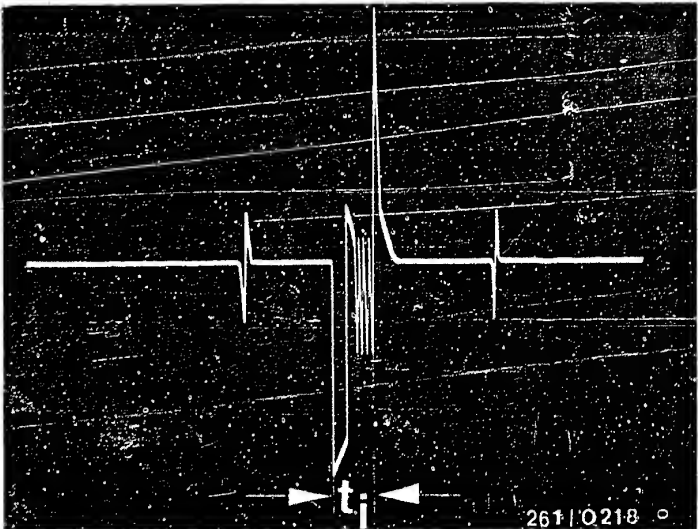
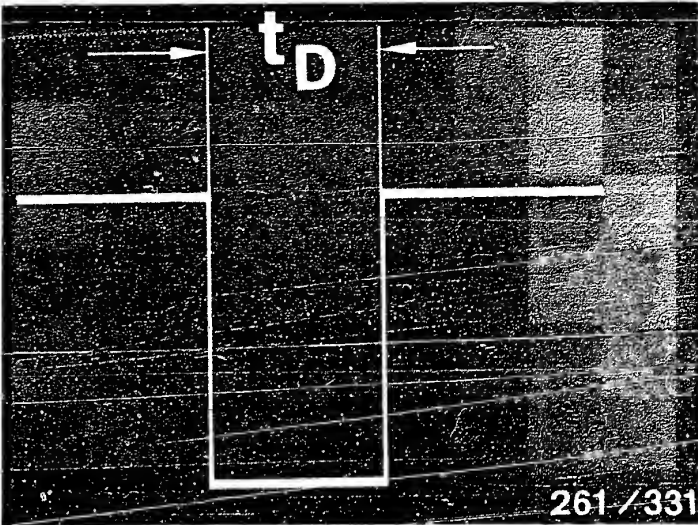
Test	step	Switch	Terms.	Testing of component/function Test instructions/conditions	Set values	
		V	Ω			
12		 V	14	30, 5	Altitude sensor. Resistance altitude-dependent.	0,4...2,8 k Ω
13		 V	15	28, 5	Switch-over of fuel variants. Dependent upon coding.	Less than 10 Ω Greater than 1 Ω
14	1		15	8,27	Engine-speed-sensor signal. Test with oscilloscope. Shift into neutral and start.	Upper illustration
15	2		15	25,26	Reference-mark-sensor signal. Test with oscilloscope. Shift into neutral and start.	Center illustration
16	3		14	10, 5	Not applicable	
17	4		15	29, 5	Switch at air conditioner. Switch on air conditioner.	Greater than 8 V
18	6		15	35, 5	Main relay. Voltage supply for control unit. Switch on ignition.	10...15 V
19	7		15	18, 5	Main relay. Voltage at term. 18 Switch on ignition.	10...15 V
20	5		15	1, 5	Switch off ignition and connect controls unit. Dwell-period signal at ignition coil term. 1. Test with oscilloscope. Shift into neutral and start.	Lower illustration



RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01

Adapter lead: without cat 1 684 463 124 / with cat 1 684 463 128

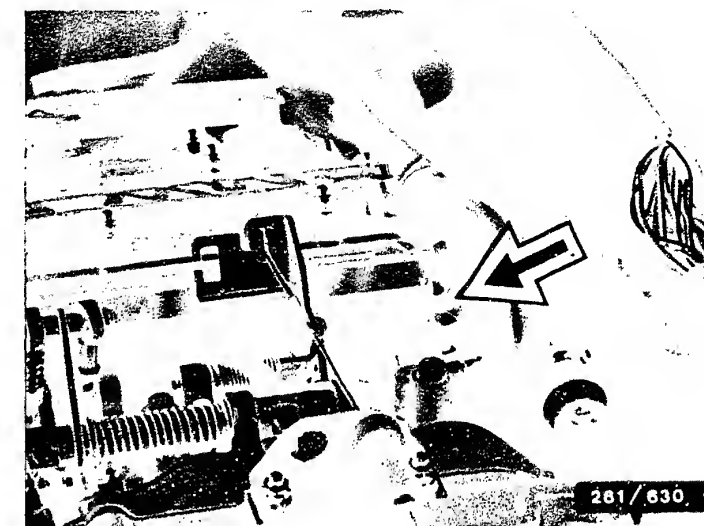
Test step	Switch	V	Ω	Terms.	Testing of component/function Test instructions/conditions	Set values
21	8	15	9, 5		Voltage supply for air-flow sensor. Switch on ignition.	Greater than 4,5 V
22	9	15	7, 5		Air-flow-sensor load signal. Switch on ignition. Air-flow sensor flap in neut. position: Fully deflect air-flow sensor flap:	200...300 mV Greater than 4,2 V
23	10	15	32, 5		Not applicable	
24	11	15	28, 5			
25	12	15	4, 5		Start signal (term. 50). Shift into neutral and start.	8...15 V
26	13	15	21, 5		Measuring output TD, test dwell-period with oscilloscope. Shift into neutral and start.	Upper illustration
27	14	15	14, 5		Injection output stage (cyl. 1+2) Test injection signal with oscilloscope. Shift into neutral and start.	Center illustration
28	15	15	15, 5		Injection output stage (cyl. 3+4) Test injection signal with oscilloscope. Shift into neutral and start.	Center illustration
29	16	15	11, 5		Measuring output ti. Test injection sig. with oscilloscope. Shift into neutral and start.	Lower illustration
30	17	15	20, 5		Pump relay Switch on ignition.	10...15 V
					Pump relay/pump activation Shift into neutral and start.	max. 4 V



RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01

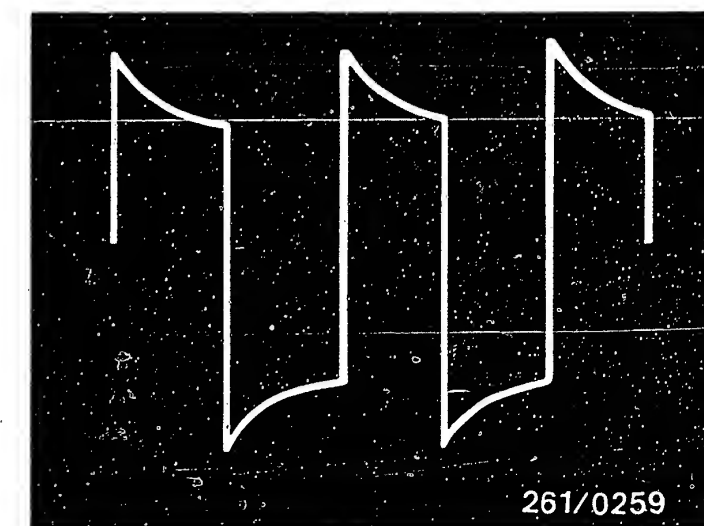
Adapter lead: without cat 1 684 463 124 / with cat 1 684 463 128

Test step	Switch		Terms.	Testing of component/function Test instructions/conditions	Set values
	V	Ω			
31	17	15		Electric fuel pump, pressure regulator/ fuel pressure Ignition off, connect pressure gauge (see upper illustration). Ignition on, press push-button T3.	2,8...3,2 bar
32	17	15		Idle speed and CO (without cat). Connect motortester, CO analyzer, diag- nostic cable (1 684 463 196) if present and leave engine (normal operating temperature) running (after activation of push-button T2, values unchanged).	800...900 min ⁻¹ 0,5...1,5 % COvol. (observe test step 42 with catalytic converter)
33	17	15		Spark advance at idle speed	-5...+5 crankshaft
				Spark advance at full load Adjust engine speed to 3000 min ⁻¹ and press push-button T6.	15...25 crankshaft 13...23 crankshaft (cat)
34	17	15		Dwell angle at idle speed	10...23
				Dwell angle at 2000 min ⁻¹	17...39
35	17	15		Test overrun cut-off. Adjust engine speed to 3000 min ⁻¹ , press push-button T5. Injection signals cut out and cut in again at just above idle speed.	Engine "hunts"
36	18	15	33, 5	Idle-actuator on/off ratio Measurement with dwell-angle tester (% scale). Clip 15 of motortester to red recess. Engine at normal operating temperature, idle speed. When push-buttons T5 and T6 depressed, idle speed should be 800...850 min ⁻¹ (if necessary, correct).	20...30 % Signal pattern, see lower illustration (special input of oscilloscope)



Arrow = Pressure-gauge connection

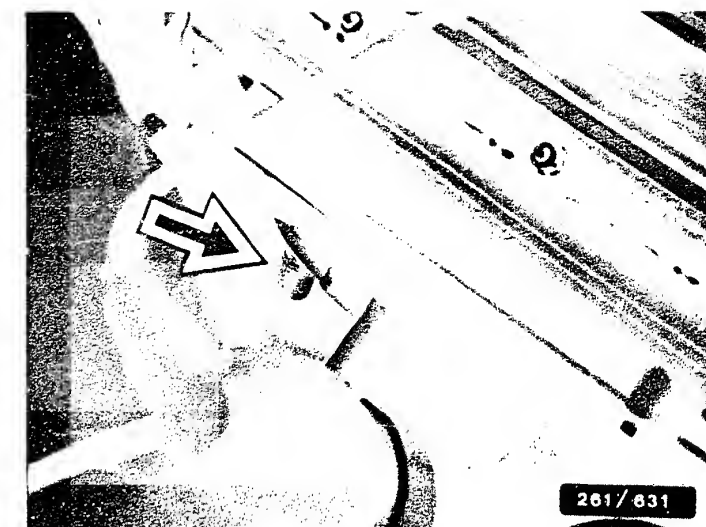
Signals at idle actuator



RAPID DIAGNOSIS CHART FOR UNVIVERSAL TEST ADAPTER ETT 018.01

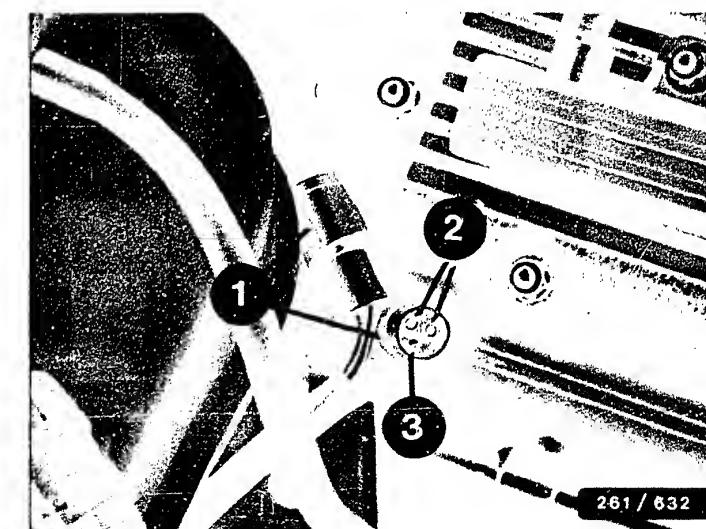
Adapter lead: without cat 1 684 463 124 / with cat 1 684 463 128

Test step	Switch V	Ω	Terms.	Testing of component/function Test instructions/conditions	Set values
37	19	15	34, 5	As Test step 37, however, measurement at second winding of idle actuator.	70...80 % Signal pattern as for first winding
38	20	15	31, 5	Relay for tank ventilation Switch on ignition.	10...15 V
				Relay for tank ventilation/activation Shift into neutral, start and slowly accelerate. Eng. speed up to approx. 1700 min ⁻¹ ; Engine speed above this value:	10...15 V max. 4 V
Operational test of lambda closed-loop control (cat models only): Connect analog voltmeter (or a LED with approx. 1 kOhm series resistance) at socket 5 in the diagnostic socket-outlet unit to positive battery terminal. Engine and catalytic converter at normal operating temperature, consuming devices switched off. Idle.					
39	20	22	24 to ground	Upper limit of lambda closed-loop cont. Test adapter applies term. 24 to grd. Note: proceed rapidly so as not to overload the catalytic converter.	10...15 V (LED lights up)
40	20	23	24 to +2V	Lower limit of lambda closed-loop control. Test adapter applies term. 24 to +2V	Less than 1 V (LED goes out; engine not running smoothly)
41	20	24	24 to lambda sensor	Lambda closed-loop-control operation. Test adapter connects term. 24 to lambda sensor. Note: if no fluctuation of pointer, ...slightly increase eng. speed ...turn CO adjusting screw ...exchange lambda sensor	0...15 V Indicator fluctuates evenly between low and high value (LED flashes)
42	17	15	24 open	Lambda closed-loop control, open-loop control value. Test adapter interrupts connection between term. 24 and lambda sensor. Engine idle.	10...15 V (LED lights up)



Arrow = Lambda sensor

- 1=Plug connection to lambda sensor (disconnected)
- 2=Sensor-heater connections
- 3=Lambda-sensor signal



SET VALUES

Pressure regulator	
Fuel pressure	2,8...3,2 bar
Electric fuel pump delivery (measured in return line)	at least 900 cm ³ /30s
Pre-supply pump	at least approx. 1000 cm ³ /30s
Supply voltage (under load):	at least 12 V

Intake-air temperature sensor	
Internal electrical resistance measured at air-sensor between term.1 and term.4 at ambient temperature (+15°C...+30°C):	1450...3300 Ω

Coolant-temperature sensor	
Plug color, blue. Internal electrical resistance at ambient temperature (+ 15° C...+ 30° C):	1450...3300 Ω
engine at normal operating temperature (approx. + 80° C):	280... 360 Ω

Solenoid-operated injection valve	
Internal electrical resistance at ambient temperature (+ 15° C...+ 30° C):	2...3 Ω

Air-flow sensor	
Internal electrical resistance between:	
Term.2 and term.4 :	8...2500 Ω (*)
Term.3 and term.4 :	500...1100 Ω

(*) Slowly deflect air-flow sensor flap
as far as it will go.
Resistance fluctuates between the
terminals of the potentiometer.

TEST SPECIFICATIONS (CONTINUED)

Engine-speed sensor and reference-mark sensor	
Internal electrical resistance between term. 1 and term. 2 at ambient temperature (+15°C...+30°C):	600...1600 Ω
Air gap:	0,8 ± 0,5 mm

Throttle-valve switch	
Resistance of idle contact (term. 2 and term. 18):	0 Ω
Resistance of full-load contact (term. 3 and term. 18):	0 Ω

Idle actuator	
Internal electrical resistance at +15°...+30°C between	
term. 1 and term. 2	19...25 Ω
term. 3 and term. 2	17...22,5 Ω

Lambda sensor	
Resistance of heater winding:	1...15 Ω

Ignition coil	
Primary resistance:	Approx. 0,8 Ω
Secondary resistance:	5000...7200 Ω

Interference-suppression resistor	
High-voltage distributor rotor:	1 k Ω
High-voltage distributor dome: each	1 k Ω
Spark-plug connector: each	5 k Ω
Spark plugs:	5 k Ω
Ignition coil:	1 k Ω

SET VALUES (2)

Altitude sensor (pressure sensor):

Overall resistance between
term.3 (+) and term.2 (-):

k Ω
2,3...2,8 Resistance

between
wiper term. 1 (+) and
term.2 (-):

0,4...2,8 k Ω
(altitude-dependent)

Idle test:

Engine at normal operating temp.,
switch off consuming devices.

Idle speed:

800...900 min $^{-1}$

Spark advance:

-5...+5 ° crankshaft

CO content: without catalytic conv. 0,5...1,5 % CO by vol.

Adjust mixture at the bypass screw

in air-flow sensor:

turning counterclockwise makes mixture leaner,

turning clockwise makes mixture richer.

Catalytic-converter vehicles:

0,2...1,2 % CO by vol.

(measure CO in front of catalytic

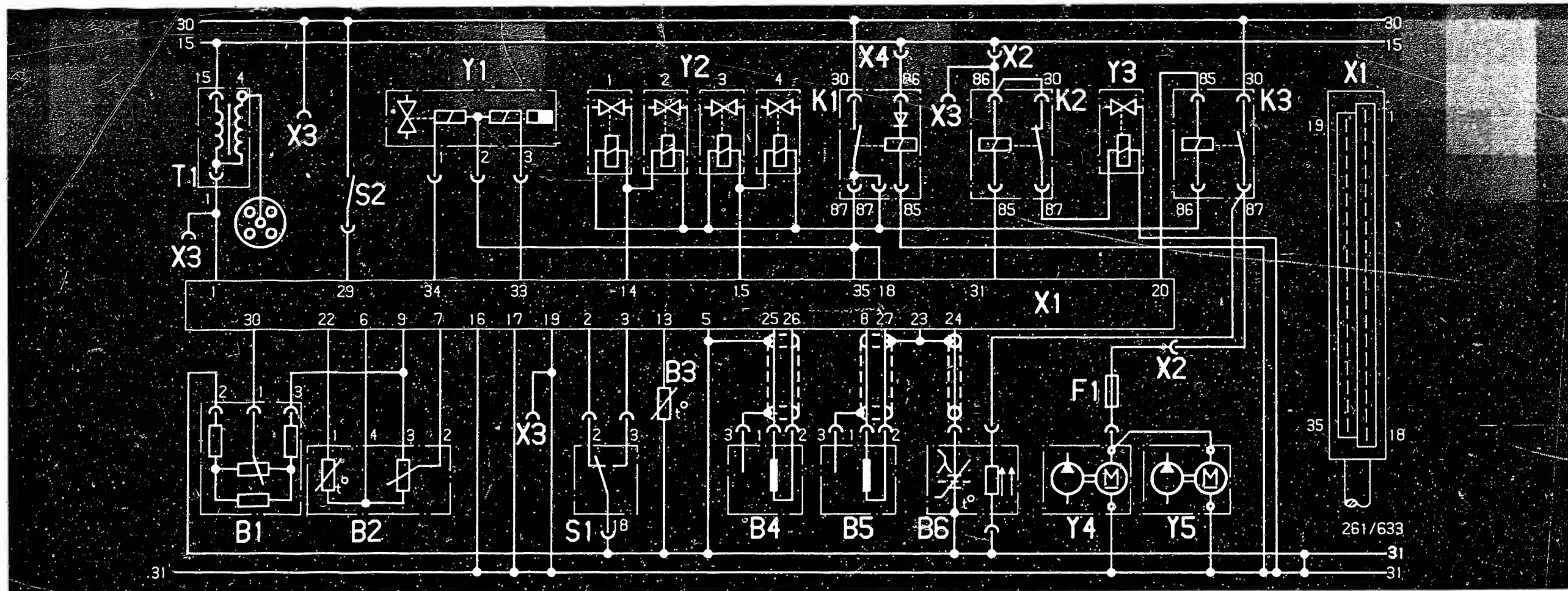
converter if sampling point

present, disconnect lambda-sensor

plug).

See equipment and Autodata microcards for the
setting values for valve clearance and other
engine-related data.

For production reasons:
continued on the following
coordinate.

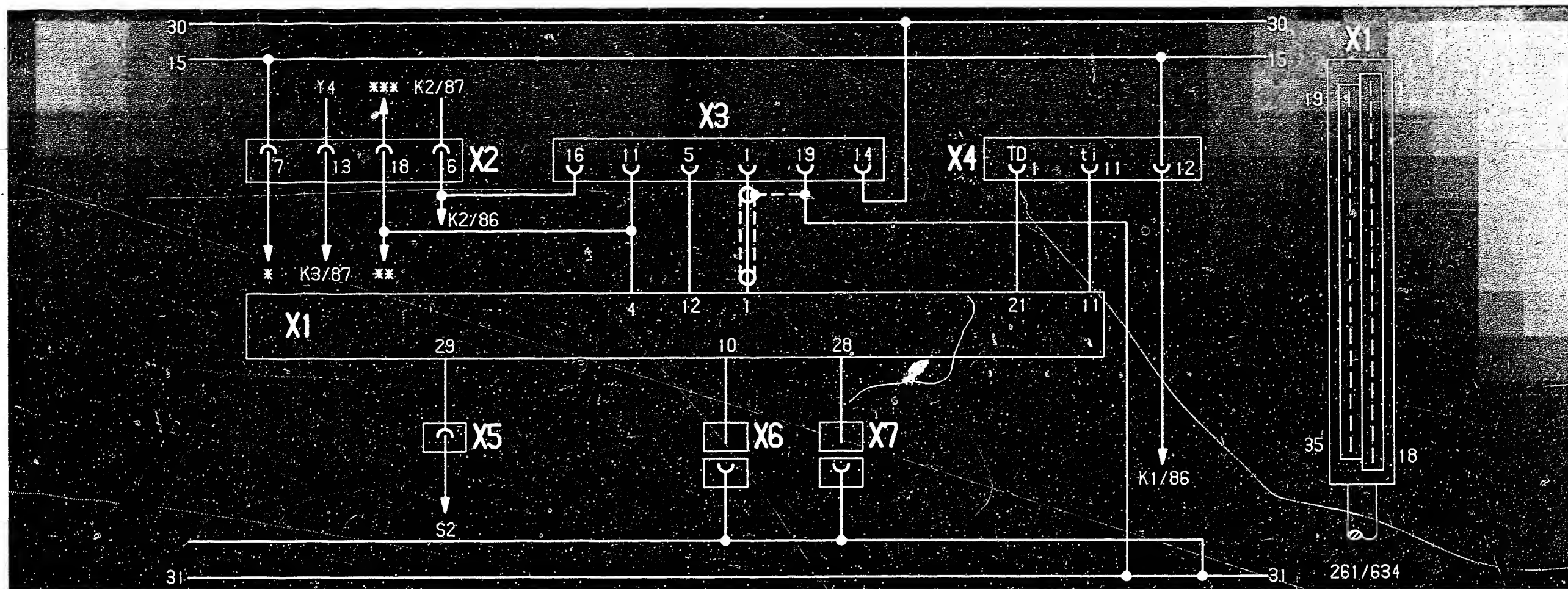


ELECTRICAL TERMINAL DIAGRAM

B1 = Altitude sensor
 B2 = Air-flow sensor
 B3 = Coolant-temperature sensor
 B4 = Reference-mark sensor
 B5 = Engine-speed sensor
 B6 = Heated lambda sensor
 (cat only)
 F1 = Pump fuse (No. 11)
 K1 = Main relay

K2 = Relay for tank ventilation
 (cat only)
 K3 = Pump relay
 S1 = Throttle-valve switch
 S2 = Switch on air conditioner
 T1 = Ignition coil
 X1 = Motronic control-unit plug
 X2 = Engine plug
 X3 = Diagnostic plug

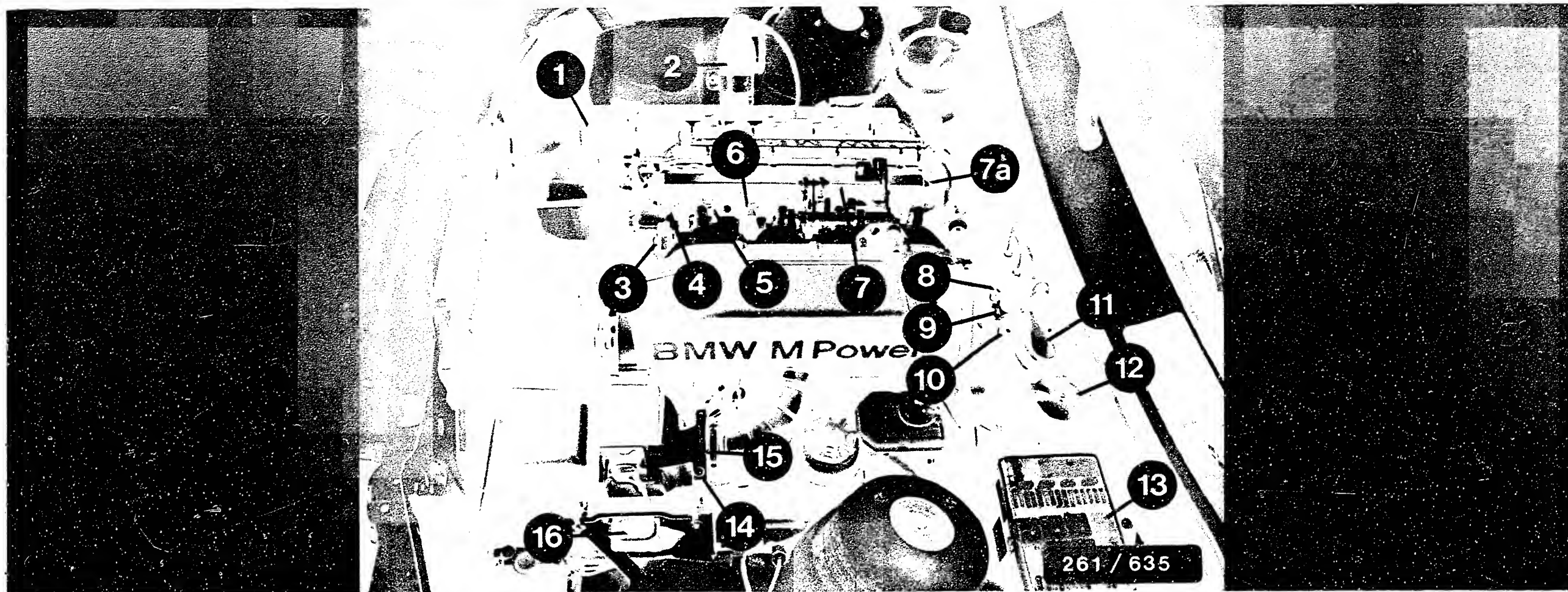
Y1 = Idle actuator
 Y2 = Solenoid-operated injection valves (cat only)
 Y3 = Tank ventilation valve
 Y4 = Electric fuel pump
 Y5 = Pre-supply pump (if present)



ELECTRICAL TERMINAL DIAGRAM (1)

X1 = Motronic control-unit plug
 X2 = Engine plug (20-pin)
 X3 = Diagnostic plug (20-pin)
 X4 = 3-pin connector
 X5 = Connection to S2
 X6, X7 = Switch-over, fuel variants (near to control unit)

* = to ignition coil term.15
 ** = to starting motor term.50
 *** = to ignition lock term.50



INSTALLATION POSITION OF COMPONENT

- | | |
|-------------------------------------|---|
| 1 = High-voltage distributor | 9 = Connection to reference-mark sensor |
| 2 = Ignition coil | 10 = Connection to TDC sensor |
| 3 = Throttle-valve switch | 11 = Engine plug |
| 4 = Fuel-pressure regulator | 12 = Diagnostic socket |
| 5 = Solenoid-operated injec. valve | 13 = Fuse box |
| 6 = Connection to idle actuator | 14 = CO adjusting screw |
| 7 = Fuel-distribution pipe | 15 = Air-flow sensor |
| 7a = Fuel inlet | 16 = Altitude sensor |
| 8 = Connection to eng.-speed sensor | |

INSTALLATION POSITION OF COMPONENTS (1)

The indications "right" and "left" always refer to the forward direction of travel.

Control unit:

In the glove compart. above the covering (upper illus).

Single-pin coding plug for switch-over of fuel variants:

At the wiring harness next to the Motronic control unit (upper illustration).

Coolant-temperature sensor:

In the coolant pipe (lower illustration).

Intake-air temperature sensor:

In the air-flow sensor.

Engine-speed and reference-mark sensors:

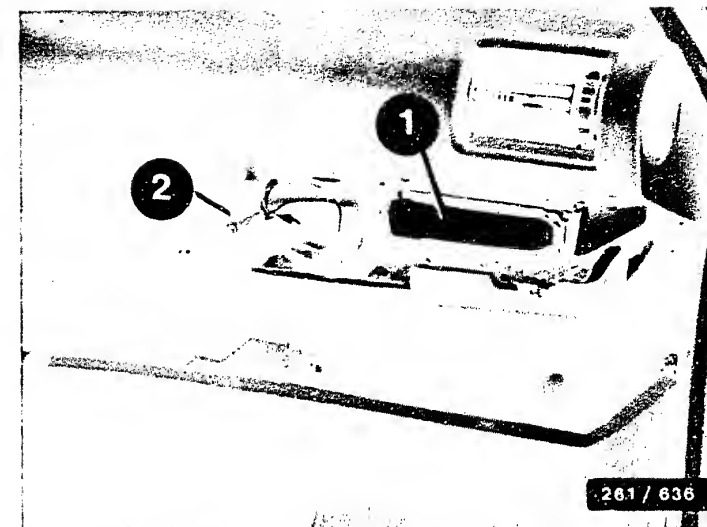
In the ring-gear-starting-motor bell at the circumference of the flywheel ring gear.

Electric fuel pump, fuel filter, fuel-pressure damper:

Beneath the vehicle in front of the left-hand rear wheel.

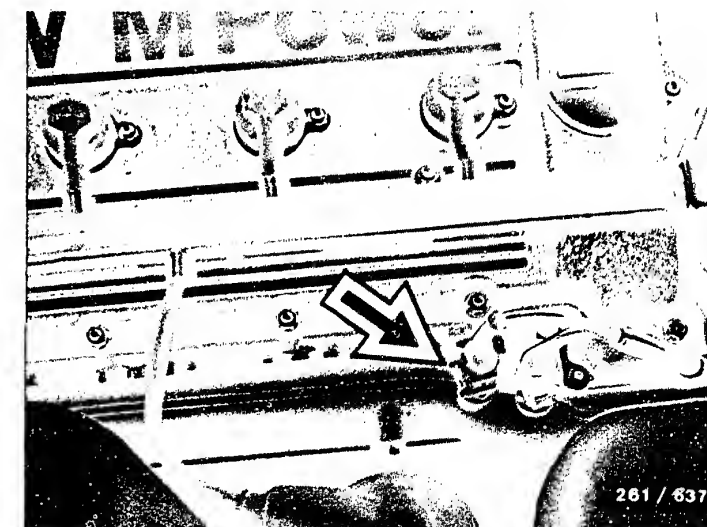
Fuse No. 11 for electric fuel pump:

In the fuse box.



- 1= Control unit
- 2= Single-pin plug for switch-over of fuel variants (2 pieces)

Arrow=Coolant-temperature sensor (blue plug)



INSTALLATION POSITION OF COMPONENTS (2)

Idle actuator:
Beneath the intake manifold.

Connector (adapter) to idle actuator:
See upper illustration, arrow.

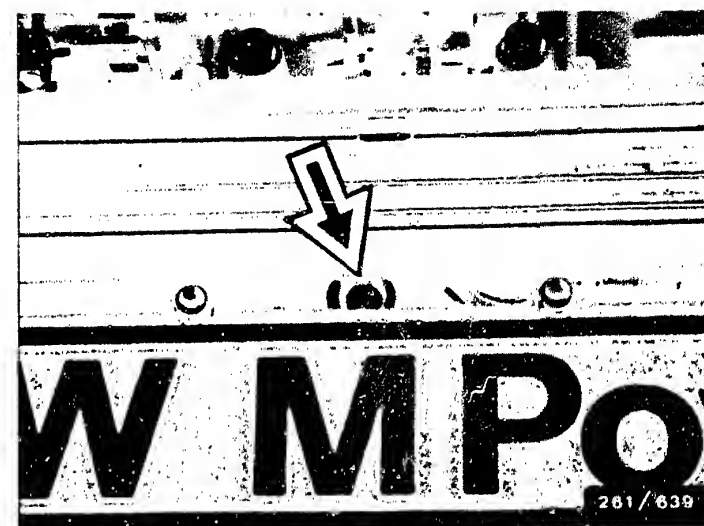
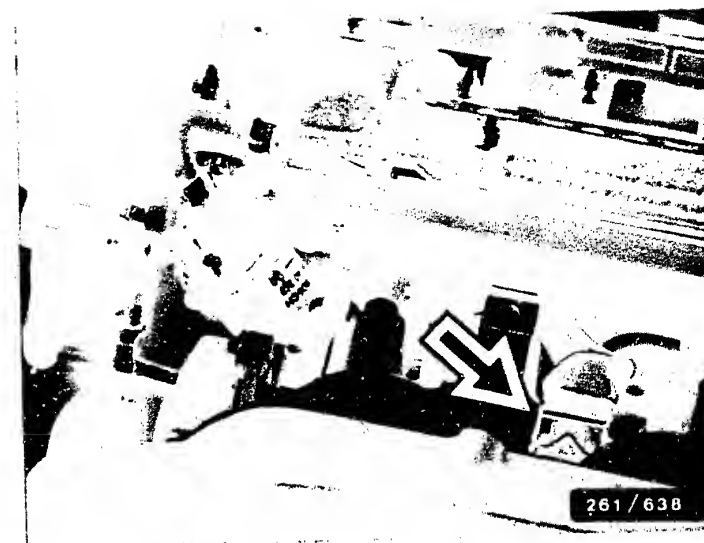
Idle-speed basic adjustment:
See center illustration, arrow.

Activated carbon canister:
See lower illustration, arrow.

Tank ventilation valve:
Next to the activated carbon canister.

CO sampling point in front of catalytic converter:
One per cylinder in the exhaust-manifold pipes.

Plug connection to lambda sensor (round, 3-pin):
Mounted on the body panel beneath the water tank of
the windshield-washer system.



Trouble-shooting instructions : VWV-5002

BOSCH system : Motronic ML 5.1
(Digifant)

Make of vehicle : Volkswagen

Basic microcard : PKW-046

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SPECIAL FEATURES

These trouble-shooting instructions, valid at the time of publication, apply to the following vehicle models:

- * VW Transporter (08.85 ->)
- * VW Caravelle (08.85 ->)

with 2.1 l / 4-cyl. opposed-cylinder engine

- Countries of application: Europe, USA

Features:

- Catalytic converter and lambda closed-loop control
- Crankshaft speed and crankshaft position are sensed via "Hall generator" (engine-speed and reference-mark sensor not present).
- Control unit with 25-pin connector
- External control unit of low-idle-speed control (not from BOSCH).

*** Construction, use:**

These brief instructions essentially comprise vehicle-specific special features and test specifications (nominal values).

The trouble-shooting chart leads to various causes/component faults, depending on the customer complaint. Detailed information for trouble-shooting can be found in the trouble-shooting chart of the basic instructions.

NOTE: Even when referring to the basic instructions, the nominal values, terminal assignments, and special features of these vehicle-specific brief instructions are always binding.

Identical test-step numbering facilitates the locating of individual test steps in the brief and basic instructions.

* Safety and preventative measures:

Do not expose persons to hazards.
Prevent damage to the engine, control unit,
and ignition system.

C A R E F U L !
High-power ignition system.
Hazardous high and low voltages.

Do not touch voltage-carrying parts or terminals, as this can be fatal, on both the primary or secondary sides.

Make sure that fuel-injection does not take place during compression testing.
To ensure this, disconnect the pump relay.

For further safety measures, see the basic instructions.

TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Rough idling (engine speed, exhaust gas).
4. Poor throttle response, flat spot during acceleration.
5. Engine misfiring (ignition, fuel injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

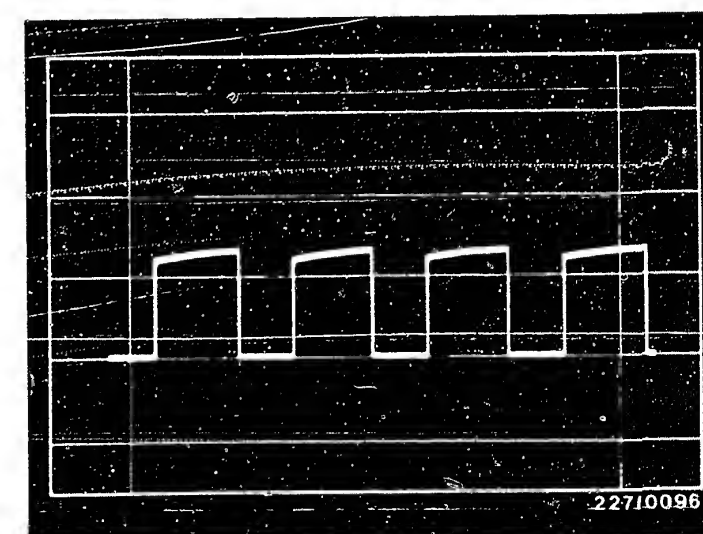
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RAPID DIAGNOSIS CHART

Test step	Testing of component/function	Test instructions/ Test conditions	Control-unit terminals	Set values
1	Leads to magnetic pulse generator (Hall generator)	Shift into neutral, switch off ignition, disconnect Digifant control unit, control unit of idle-speed control, and pump relay. Disconnect plug from ignition distributor and bridge all three connections. Measure resistance at open control-unit plug (25-pin) using test prods. Caution, do not damage spring contacts!	8 \Leftrightarrow 6 and 18 \Leftrightarrow 6	Less than 5 Ω
2	Temperature sensor (air). Resistance	At +15...+30°C	9 \Leftrightarrow 6	1,45...3,3 k Ω
3	Temperature sensor (engine). Resistance	At +15...+30°C With engine at normal operating temperature:	10 \Leftrightarrow 6	1,45...3,3 k Ω 280...360 Ω
4	Throttle-valve switch. Idle contact	Accelerator pedal not actuated: Slightly actuate accelerator pedal (part-load range):	11 \Leftrightarrow 6	Less than 5 Ω Greater than 1 M Ω
5	Throttle-valve switch. Full-load contact	Fully depress accelerator pedal to floor (full-load stop): Slowly release accelerator pedal:	11 \Leftrightarrow 6	Less than 5 Ω Greater than 1 M Ω
6	Air-flow sensor (potentiometer). Resistance		17 \Leftrightarrow 6	500...1100 Ω
7	Air-flow sensor (potentiometer wiper). Resistance	Slowly deflect air-flow sensor flap as far as it will go	21 \Leftrightarrow 6	8...2500 Ω
8	Injection valves (4) Winding resistance	At +15...+30°C Note: only one injection valve connected at one time	12 \Leftrightarrow 14	each 15...17,5 Ω
9	Lead to lambda sensor	Pull apart single plug-in connection to lambda sensor: Apply lambda input (green lead to control unit) to ground:	2 \Leftrightarrow 13	Greater than 1 M Ω Less than 5 Ω
10	Heating winding of lambda sensor		14 \Leftrightarrow 13	1...15 Ω (temperature-dependent)

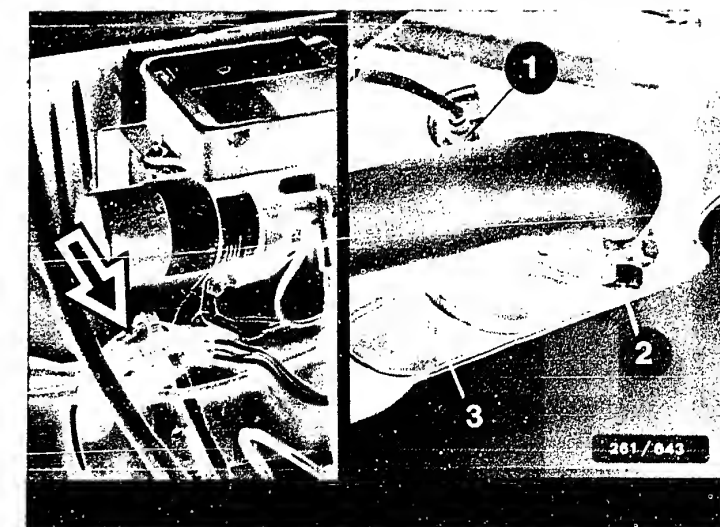
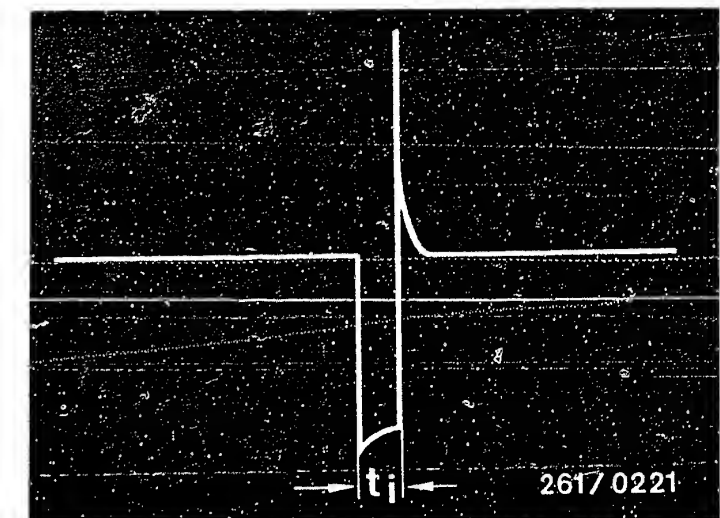
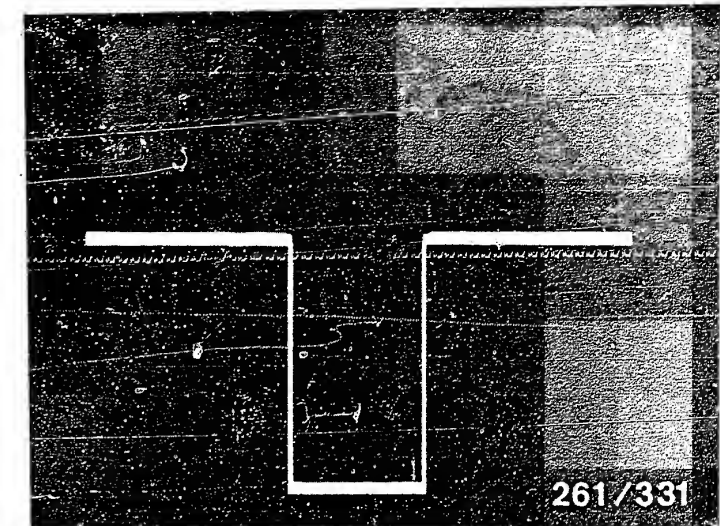
RAPID DIAGNOSIS CHART (Continued)

Test step	Testing of component/function Test instructions/conditions	Control-unit terminals	Set values
11	Voltage measurement, switch over measuring range! Main relay + instrument leads. Voltage supply for control unit. Switch on ignition.	14<=>13 and 14<=>19	10...15 V
12	Pump relay + instrument leads. Activation of electric fuel pump. Ignition switched on.	3<=>13	10...15 V
13	Fuel pressure. Switch off ignition; connect pressure gauge (upper illustration, item 2). Switch on ignition. Bridge term. 3 and term. 13 in control-unit plug (electric fuel pump must begin to run audibly).		2,3...2,7 bar
14	Lead to term. 50 (starting motor). Start signal. Shift into neutral and start.	1<=>13	8...15 V
15	Ignition coil (primary winding) with instrument leads to term. 15 and term. 1. Switch on ignition.	25<=>13	10...15 V
16	Digifant control unit. Voltage supply for magnetic pulse generator. Connect control unit, push back rubber sleeve of plug at ignition distributor (upper illustration, item 1). Measure voltage at the two outer leads (+ and -) using test prods. Switch on ignition.	8<=> 6	10...15 V
17	Magnetic pulse generator. Switching function Switching operation as before, however, with oscilloscope (special input) at center connection (0) and vehicle ground, test voltage characteristic. Start engine.	18<=> 6	See lower illustration.



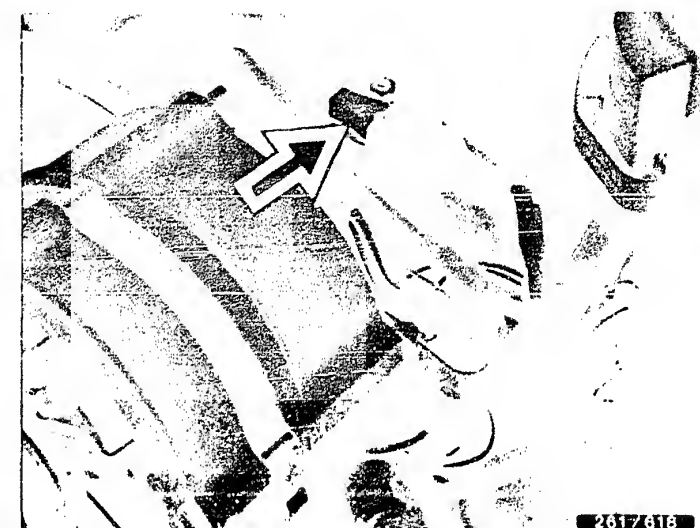
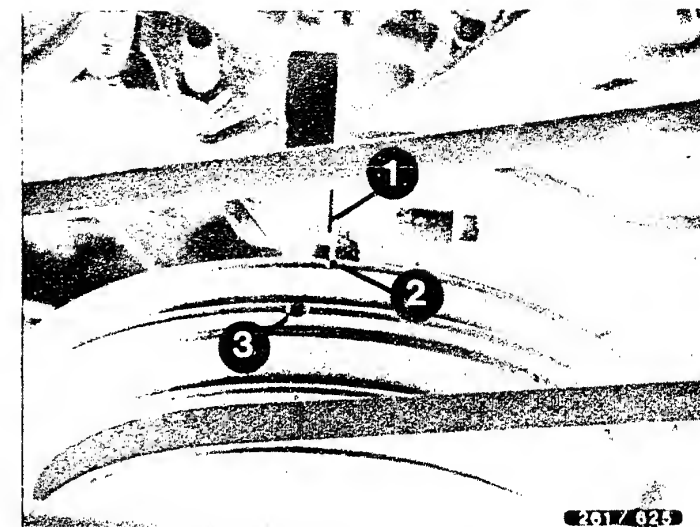
RAPID DIAGNOSIS CHART (Continued)

Test step	Testing of component/function Test instructions/conditions	Control-unit terminals	Set values
18	Dwell-period signal. Using oscilloscope (special input), test at ignition coil term. 1 Shift into neutral and start.	25 \leftrightarrow 6	See upper illustration
19	Injection signal. Using oscilloscope, test directly at injection valve (test lead 1 684 463 093). Shift into neutral and start. Duration of injection dependent upon engine temperature (NTC II). With engine running, briefly disconnect plug from engine-temperature sensor.	12 \leftrightarrow 6	See center illustration Duration of injection becomes longer (observe oscilloscope)
20	Voltage supply, air-flow sensor. Push back rubber sleeve on air-flow sensor plug and measure voltage between connections 3 and 4 using test prods. Switch on ignition.	17 \leftrightarrow 6	> 4,5 V
21	Air-flow sensor (wiper). Load signal. As above, however, measure between connections 2 and 4.	21 \leftrightarrow 6	Air-flow sensor flap in rest position: 0,2...0,3V Air-flow sensor flap fully deflected: > 4,2 V
22	Idle speed and CO. Connect motortester and CO analyzer (sample pickup in front of catalytic converter; lower illustration, Item 2). Disconnect single plug-in connection of lambda sensor (lower illustration, arrow) and of idle actuator before measuring.		830...930 min ⁻¹ 0,3...1,1 % CO by vol.

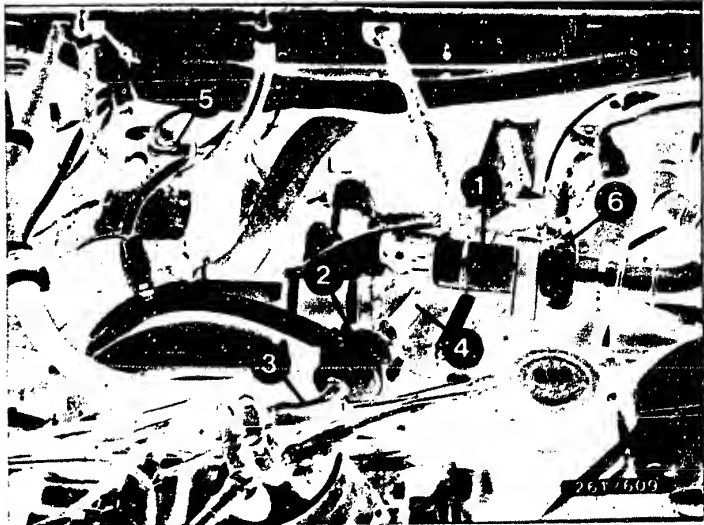
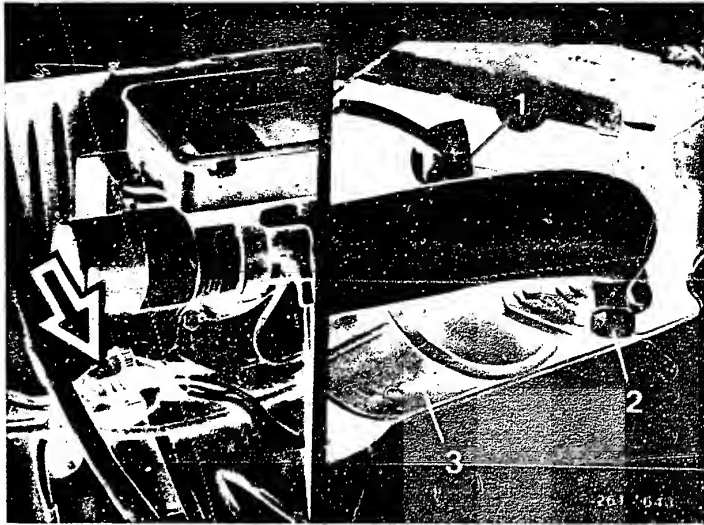


RAPID DIAGNOSIS CHART (Continued)

Test step	Testing of component/function Test instructions/conditions	Control-unit terminals	Set values
23	<p>Test spark advance (basic value). Engine at normal operating temperature, plug of temperature sensor (engine) <u>disconnected</u>, engine speed 2000...2500 min⁻¹. Upper illustration: 1 = Reference edge 2 = Ignition marking 5° crankshaft 3 = TDC</p> <p>Connect plug of temperature sensor (engine); Engine speed approx. 3000 min⁻¹. Subtract the basic value from spark advance indicated and determine adjustment value:</p>		<p>Basic value: 3...7 °crankshaft</p> <p>Adjustment value: 30...40 °crankshaft</p>
24	<p>Overrun cut-off. Pull apart plug connection to throttle-valve switch and bridge in plug on control-unit side (center illustration, arrow). Start engine (normal operating temperature) and accelerate slightly. Note: accelerating first and then bridging the plug is also possible.</p>		Engine hunts
25	<p>Low-idle-speed control. Measure idle-actuator current. Idle speed, engine at normal operating temperature, consuming devices switched off, disconnect hose for crankshaft ventilation from oil vent and seal off.</p> <p>Disconnect single plug-in connection (lower illustration, Item 5): Connect single plug-in connection:</p> <p>Switch on consuming devices (e.g. headlamps, air conditioner, etc.):</p>		<p>Approx. 430 mA Approx. 430 mA fluctuating</p> <p>Depending upon load 430...1000 mA</p>



Test step	Testing of component/function Test instructions/conditions	Control -unit termi- nals	Set values
26	<p>Lambda-closed-loop control upper limit. Connect CO analyzer in front of catalytic converter. Idle speed; engine and catalytic converter at normal operating temperature; disconnect plug-in connection to lambda sensor (upper illustration, left - arrow) and apply connection on control-unit side (lambda input) to ground.</p> <p>Upper illustration, right: 1 = Lambda sensor 2 = CO connection 3 = Catalytic converter</p>		CO increases to above 1,1 % by vol. (Carry out test step quickly)
27	As Test step 26, however, test lambda closed-loop control lower limit. Lambda input to approx. +2 V, e.g. to positive terminal of a 1.5 V monocrystal (connect negative terminal to vehicle ground).		CO falls below 0,3 % by vol. (rough idling)
28	<p>Control unit and lambda sensor in closed-loop control mode. Plug-in connection to lambda sensor connected; run engine (at normal operating temperature) at idle; note down CO value:</p> <p>Disconnect air hose from fuel-pressure regulator and seal off (lower illustration, item 3).</p>		<p>CO= 0,3...1,1% by vol.</p> <p>CO increases briefly and drops back to control value specified above</p>



TEST SPECIFICATIONS

Idle speed: 830...930 min⁻¹

Exhaust-gas setting
 * CO value with engine at normal operating temperature: 0,3...1,1 % by vol.

Pressure regulator
 * Fuel pressure: 2,3...2,7 bar

Electric fuel pump
 * Fuel delivery (measured in return line) at least 500 cm³ /30s

Supply voltage (under load): at least 12 V

Temperature sensor (engine)
 Internal electrical resistance at

* Ambient temperature (+15°C...+30°C): 1,45...3,3 k Ω

* With engine at norm. op. temp. (approx. +80°C): 280...360 Ω

Solenoid-operated injection valve:
 Internal electrical resistance at

* Ambient temperature (+15°C...+30°C): 15...17,5 Ω

Idle actuator (not from Bosch)
 * Internal electrical resistance: approx. 4 Ω

TEST SPECIFICATIONS (continued)

Air-flow sensor

* Internal electrical resistance
 between term.2 and term.4: 8...2500 Ω (1)
 term.3 and term.4: 500...1100 Ω

(1) = (Deflect air-flow sensor flap as far as it will go).

Temperature sensor (intake air)

* Internal electrical resistance measured at air-flow sensor between term.1 and term.4 at ambient temperature (+15°C...+30°C): 1,45...3,3 k Ω

Ignition coil

* Primary resistance (term.1/term.15): 0,5...0,8 Ω

* Secondary resistance (term.1/term.4): 2,4...3,5 k Ω

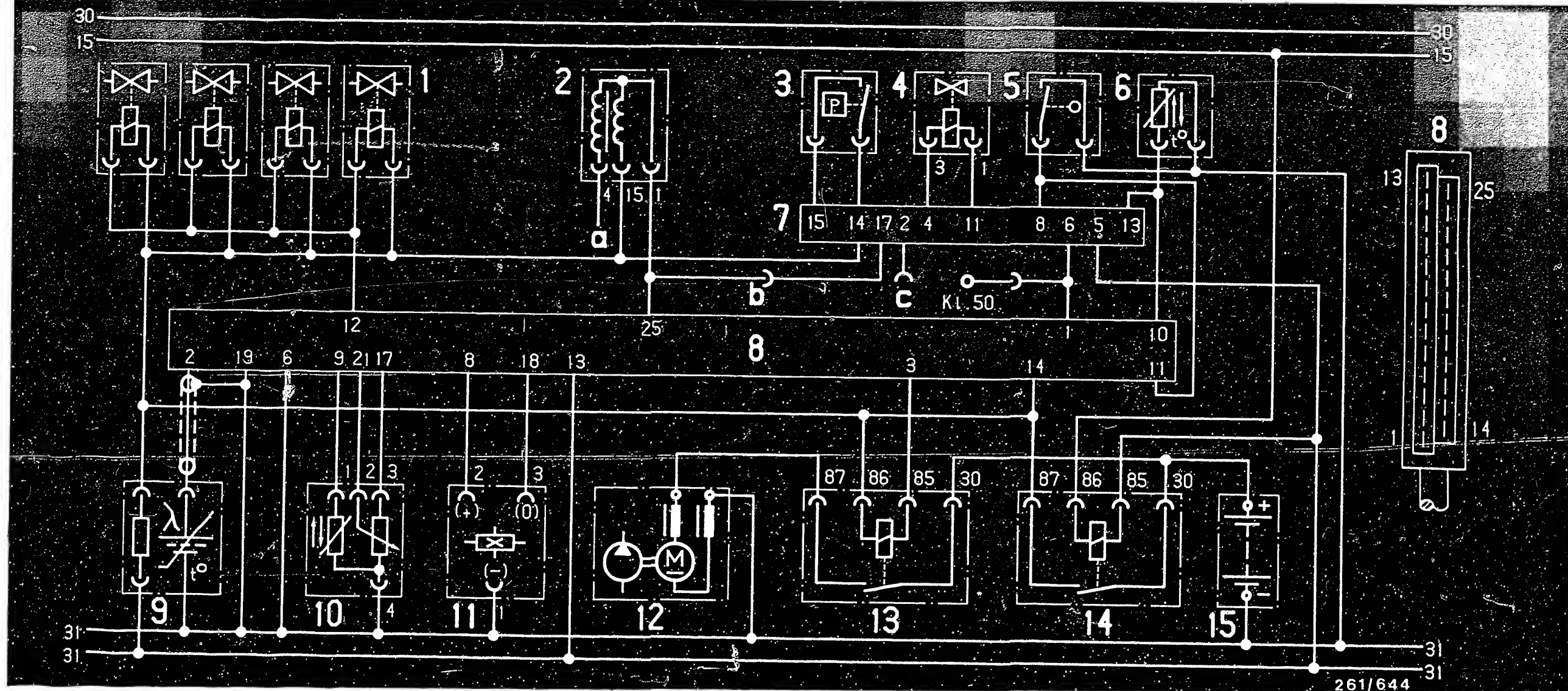
Lambda-sensor heater winding: 1...15 Ω

Interference-suppression resistors

* Ignition-distributor rotor: 0,6...1,4 k Ω

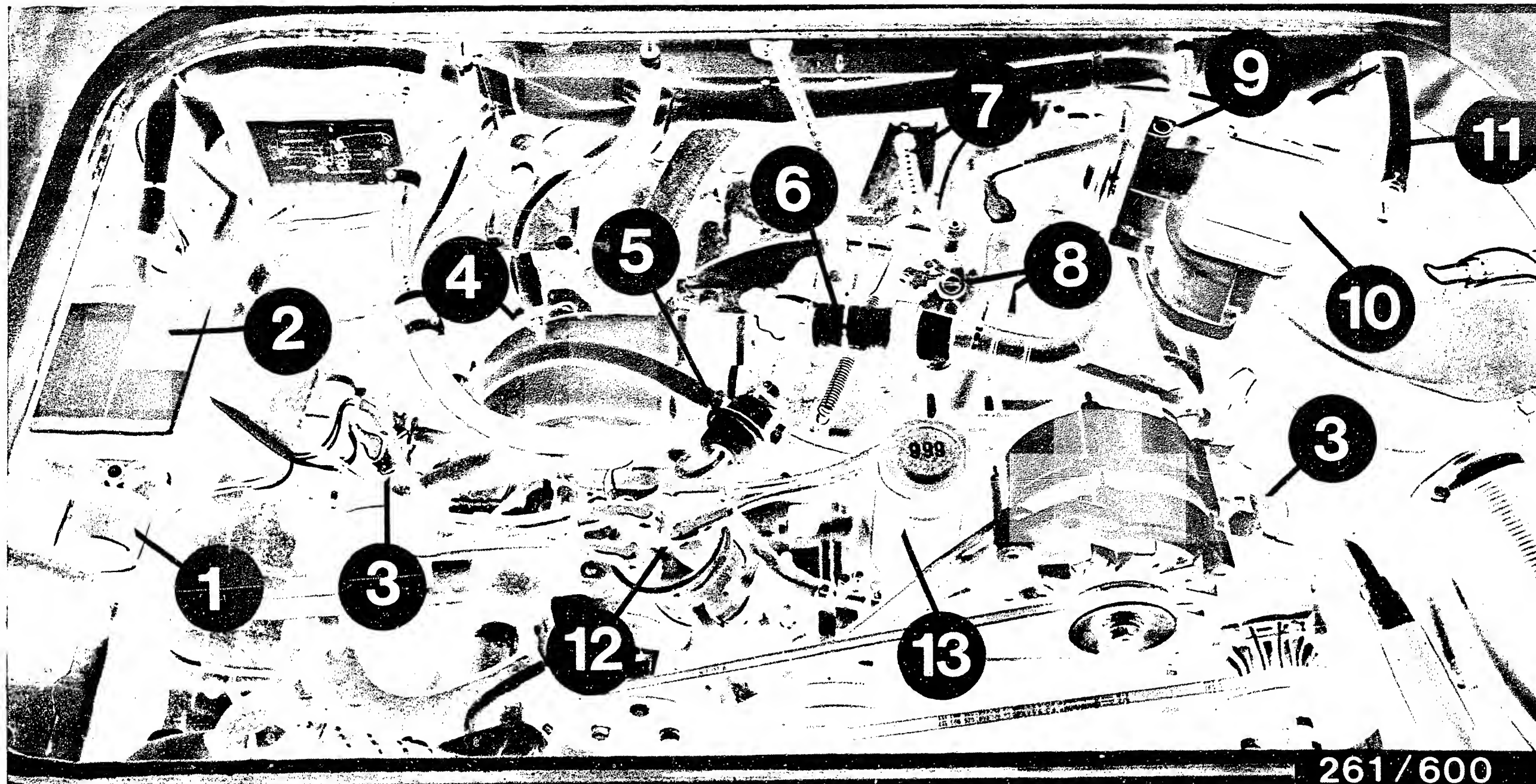
* Distributor cap: 0,6...1,4 k Ω

* Spark-plug connector: 4... 6 k Ω



ELECTRICAL TERMINAL DIAGRAM

- | | | |
|------------------------------------|--|-------------------------|
| 1 = Solenoid-operated injec. vlv. | 7 = Idle controller | 12 = Electric fuel pump |
| 2 = Ignition coil | b = Plug-in connection | 13 = Pump relay |
| a = to high-voltage distributor | c = Test connection | 14 = Main relay |
| 3 = Pres.-switch pwr.-asst. steer. | 8 = Control-unit plug | 15 = Battery |
| 4 = Idle actuator | 9 = Lambda sensor (heated) | |
| 5 = Throttle-valve switch | 10 = Air-flow sensor | |
| 6 = Temperature sensor (engine) | 11 = Magnetic pulse generator (Hall generator) | |

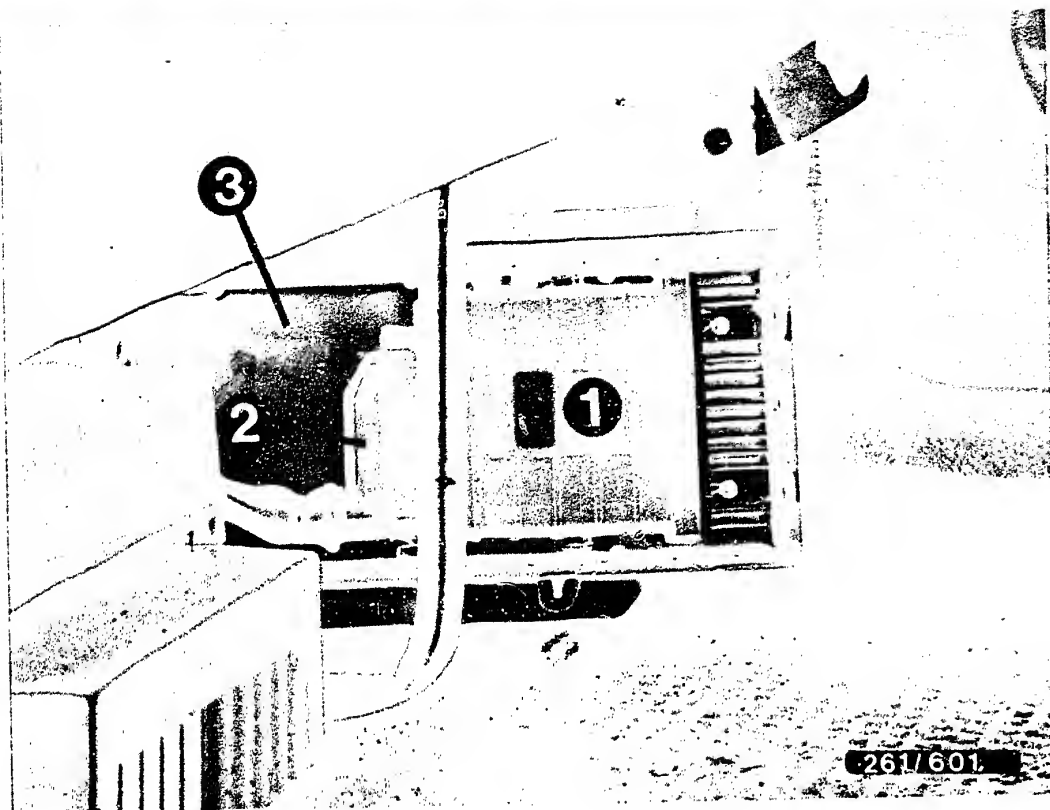


261/600

INSTALLATION POSITION OF COMPONENTS

- 1 = Ignition coil
- 2 = Main and pump relays
- 3 = Injection valves
- 4 = Temperature sensor (engine)
- 5 = Pressure regulator
- 6 = Idle actuator
- 7 = Throttle cable

- 8 = Idle-speed adjusting screw
- 9 = CO adjusting screw
- 10 = Air-flow sensor
- 11 = Hose to active carbon canister (tank ventilation)
- 12 = Ignition distributor
- 13 = Oil vent



- 1 = Control unit
- 2 = 25-pin plug
- 3 = Sheet-metal cover

INSTALLATION POSITION OF COMPONENTS (continued)

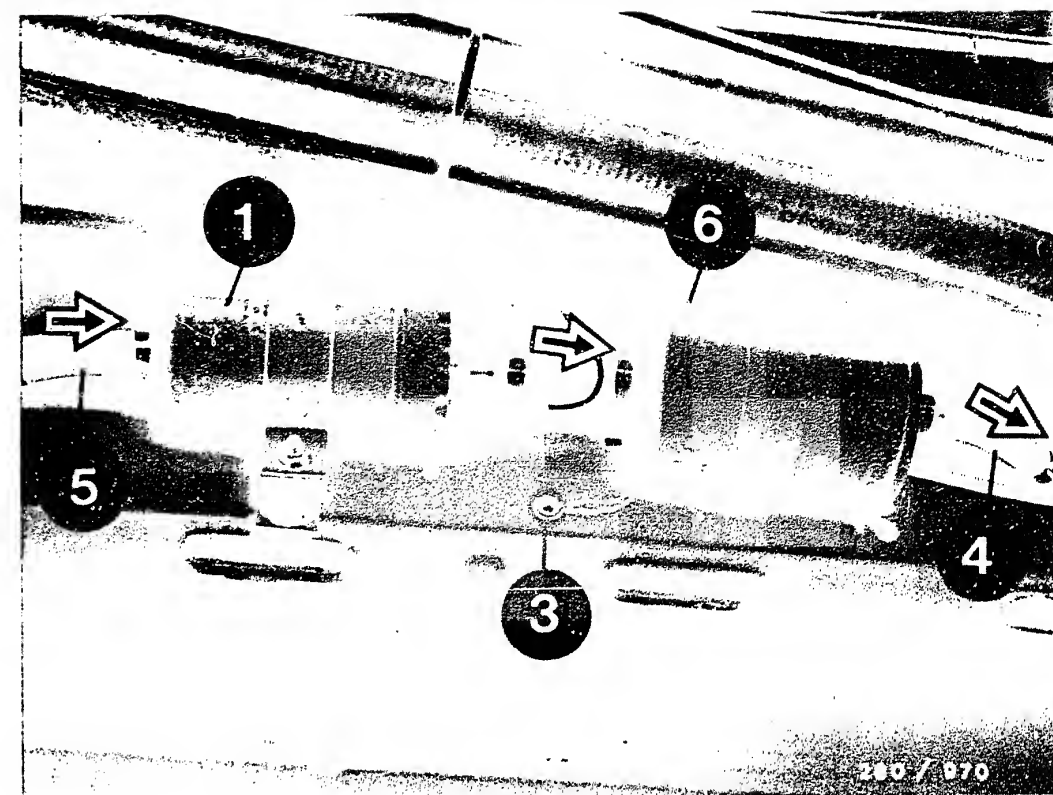
The indications "right" and "left" always refer to the forward direction of travel.

Control unit:

Beneath the rear seat bench (remove footwell covering and unscrew control unit together with sheet-metal cover from floor pan).

Fuel pump and fuel filter:

beneath the vehicle (approx. center of floor pan).



- 1 = Electric fuel pump
 - 3 = Ground connection of electric fuel pump
 - 4 = Fuel delivery line
 - 5 = Fuel intake line
 - 6 = Fuel filter
- Arrow = Direction of fuel flow

INSTALLATION POSITION OF COMPONENTS (cont.)

There is also a fuel-intake filter in the fuel intake line (before the electric fuel pump).

TABLE OF CONTENTS

Trouble-shooting instructions	: ALF-5003
BOSCH system	: Motronic ML 4.1
Make of vehicle	: ALFA ROMEO
Basic microcard	: ALF 506

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Tests for which no coordinate is specified are not relevant to these trouble-shooting instructions.

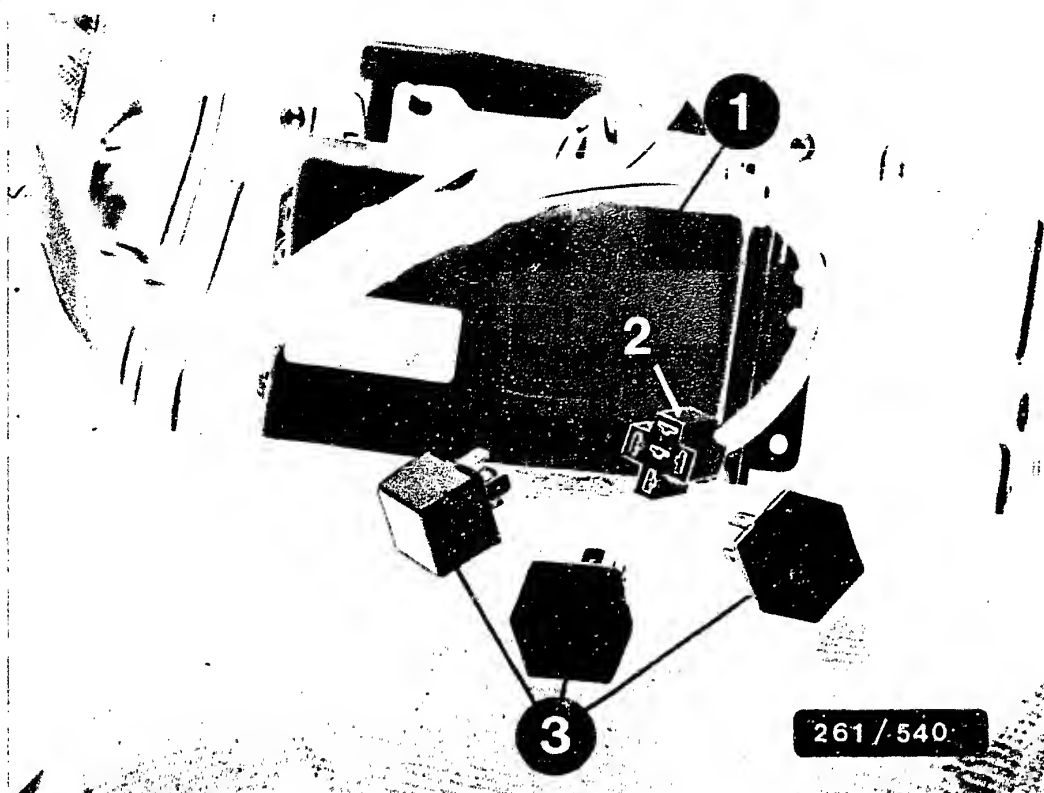
SPECIAL FEATURES

This microcard contains the test and repair instructions for the Motronic in the

- Alfa 75
with 2.0 l / 4-cyl. engine as of 10.86
for Europe.

New in this vehicle:

- * Double ignition (2 spark plugs per cylinder; 2 ignition coils with flange-mounted ignition trigger boxes TI-61 activated by Motronic term. 1 and term.19; (2 ignition distributors).
- * Air-flow sensor with CO pot (CO adjustment electrical via a potentiometer).
- * Low-idle-speed control
(auxiliary-air device not applicable).
- * Only 1 sensor for engine-speed/reference-mark sensing (single-sensor system).



- 1 = Motronic control unit
 2 = Relay frame at wiring harness
 3 = Encoding components (varicolored mini-relay housing)

SPECIAL FEATURES

* Variant coding

Without cata- lytic converter	Term.10	Term.27	Encoding component (relay hou.)
97 RON	Infinity Ohms (open)	Infinity Ohms (open)	None
95 RON	0 Ohms (at ground)	Infinity Ohms (open)	Red
Scheduled for closed-loop operation with catalytic conv.	Term.10	Term.27	Encoding component (relay housing)
95 RON	Infinity Ohms (open)	0 Ohms (at ground)	Yellow
91 RON	0 Ohms (at ground)	0 Ohms (at ground)	Blue

STRUCTURE, USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to various causes/component faults.

For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.
SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to prevent damage to the engine, trigger boxes and control units or to the ignition system, be sure to observe the information in the basic instructions.

CAUTION!

High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

- * Avoid injection of fuel and high-voltage flashovers when testing the compression.
 To ensure this, disconnect main relay.

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER

The following rapid diagnosis chart makes it possible for the experienced Motronic expert to quickly check the electrical part of the system using the universal test adapter.

The rapid diagnosis chart contains the following data:

- * Test-step sequence.
- * Position of the V- and Ω -program switches.
- * Notes on operation of universal test adapter or other components.
- * Test specifications for motortester and multimeter.

For production reasons:
continued on the following
coordinate.

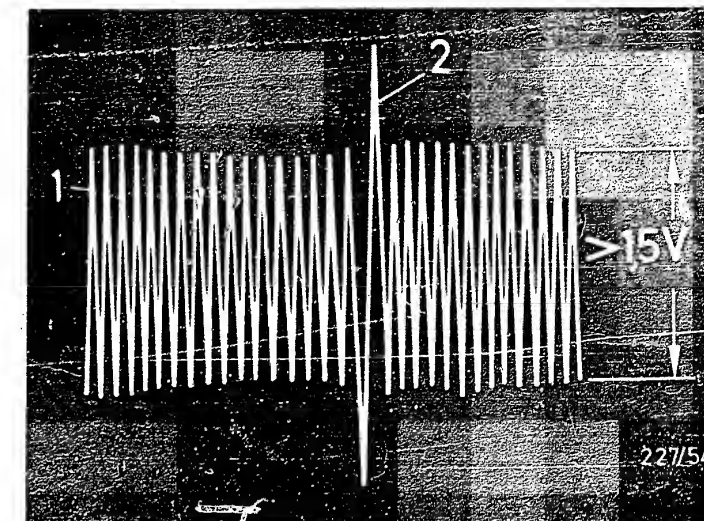
RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER (CONTINUED)

Applies to control unit 0 261 200 108

Test step	Switch position V	Ω	Measurement	Measurement at control-unit plug between term.	Remarks	Set values
1	 V	1	Not applicable	8 and 5	—	
2	 V	2	Winding resistance of engine-speed/reference-mark sensor.	25 and 5	Shift into neutral. Ignition off. Disconnect control unit and pump fuse, or pump relay.	400...800 Ω
3	 V	3	Not applicable	8 and 27	—	
4	 V	4	Not applicable	25 and 26	—	
5	 V	5	Resistance of coolant-temperature sensor	13 and 5	Resistance temperature-dependent. At +15° C...+30° C : At +80° C (engine at norm. op. temp.):	1,45...3,3 k Ω 280...360 Ω
6	 V	6	Resistance of intake-air temperature sensor	22 and 5	Resistance temperature-dependent. At ambient temp. +15° C...+30° C :	1,45...3,3 k Ω
7	 V	7	Resistance of characteristic-map switch	10 and 5	Ignition-map selection. For unleaded premium(min. 95 RON) : For leaded premium (min. 97 RON) :	Less than 10 Ω Greater than 1 M Ω
8	 V	8	Not applicable	29 and 5	—	
9	 V	9	Throttle-valve switch: Resistance of idle contact.	2 and 5	Accelerator pedal in idle position: Slightly open throttle valve:	Less than 10 Ω Greater 1 M Ω than
10	 V	10	Throttle-valve switch: Resistance of full-load contact.	3 and 5	Fully depress accelerator pedal:	Less than 10 Ω

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER (CONTINUED)

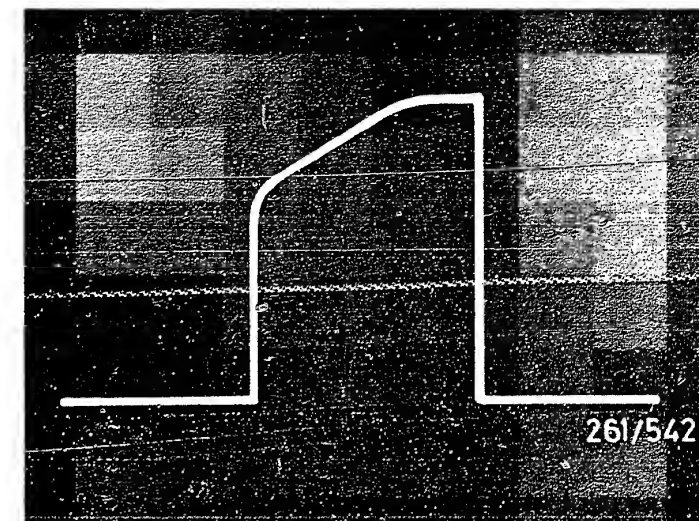
Test step	Switch position V Ω	Measurement and remarks	Measurement at control-unit plug between term.	Set values
11	V	11 Resistance of ground cable	16 and 5	Less than 10 Ω
12	V	12 Not applicable	17 and 5	
13	V	14 Resistance of idle CO potentiometer (wiper).	30 and 5	0...550 Ω Depending upon adjustment
14	V	15 Not applicable	28 and 5	
15	1	15 Not applicable	8 and 27	
16	2	15 Engine-speed/reference-mark sensor signal with oscilloscope. Shift into neutral and start.	25 and 23	See upper illustration
17	3	15 Not applicable	10 and 5	
18	6	15 Voltage of main relay (voltage supply, control unit). Ignition on.	35 and 5	10...15 V
19	7	15 Continuous voltage supply, control unit. Ignition on.	18 and 5	10...15 V



1 = Engine-speed signal
2 = Reference-mark signal

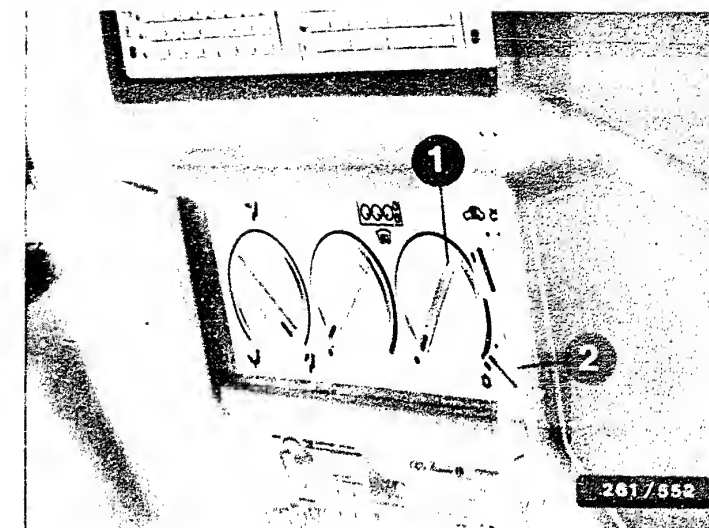
RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER (CONTINUED)

Test step	Switch position V Ω	Measurement and remarks	Measurement at control-unit plug between term.	Set values
20	5 15	Activation of first ignition output stage. Signal with oscilloscope. Ignition on. Connect control unit! Shift into neutral and start.	1 and 5	See above illustration
21	1 13 V	Caution! Voltage measurement at Ω sockets (reverse polarity of instrument lead if indication negative). Activation of second ignition output stage. Signal with oscilloscope. Shift into neutral and start.	19 and 5	See above illustration
22	8 15	Voltage supply for air-flow sensor. Ignition on.	9 and 5	Greater than 4,5 V
23	9 15	Wiper voltage of potentiometer in air-flow sensor. Ignition on.	7 and 5	Air-flow sensor flap in neutral pos.: 100...300 mV Air-flow sensor flap fully opened: greater than 4,2 V



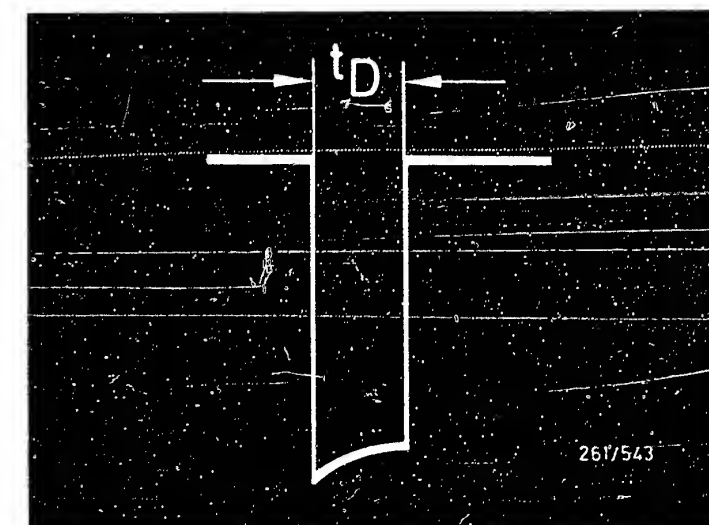
RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER (CONTINUED)

Test step	Switch Position V Ω	Measurement and remarks	Measurement at control-unit plug between term.	Set values
24	4 15	<p>Switch at air conditioner (if present).</p> <p>Connect pump fuse and/or pump relay; leave engine running.</p> <p>Air conditioner off (blower off):</p> <p>Air conditioner on (switch on blower, set temperature thumbwheel to minimum, upon which compressor should not start up):</p> <p>Note: if temperature in vehicle too low, compressor does not start up.</p>	29 and 5	<p>approx . 0 V</p> <p>10...15 V</p>
25	10 15	As test step 24, however,	32 and 5	10...15 V
26	11 15	Not applicable	28 and 5	
27	12 15	Not applicable	4 and 5	
28	13 15	Dwell-period signal with oscilloscope. Shift into neutral and start.	21 and 5	See lower illustration



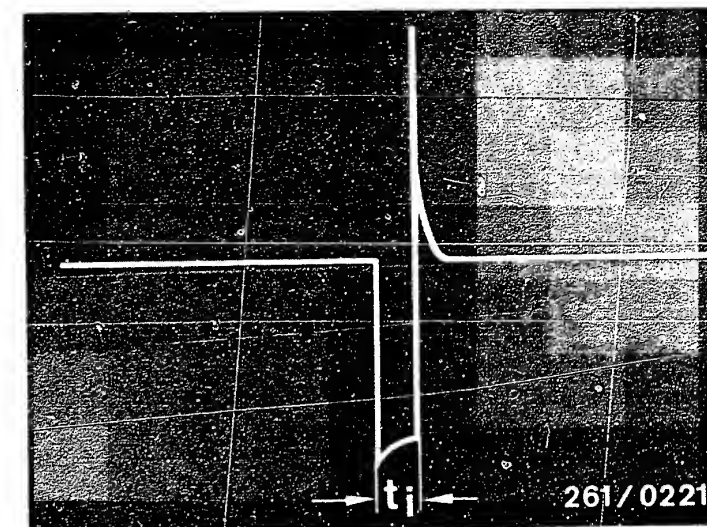
- 1 = Temperature thumbwheel for air-conditioning control
- 2 = Blower switch

Dwell-period signal
 t_D = Dwell period



RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER (CONTINUED)

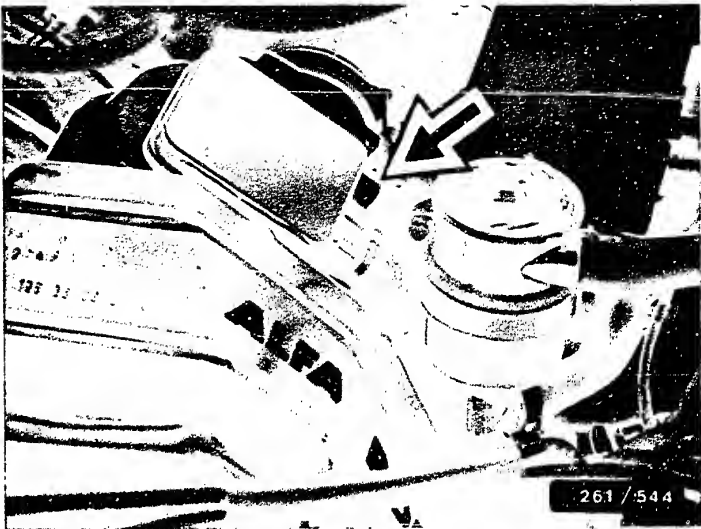
Test step	Switch position V	Ω	Butt-on	Measurement and remarks	Measurement at control-unit plug between term.	Set values
29	14	15	—	Injection signal from control unit with oscilloscope. Shift into neutral and start.	14 and 5	See illustration
30	14	15	T1	As 29, however, duration of injection becomes slightly longer after push-button is pressed (NTC II, cold). Press push-button for only 2 seconds.	14 and 5	See illustration t_i becomes slightly wider
31	15	15	—	Voltage at input of variant-coding resistor. Ignition on.	15 and 5	0...5,5 V Depending upon coding
32	16	15	—	Not applicable	11 and 5	
33	17	15	—	Voltage at pump relay. Push in pump fuse. Ignition on.	20 and 5	10...15 V
34	17	15	—	Voltage at pump relay. Pump control in control unit is under test. Shift into neutral and start.	20 and 5	Max. 4 V
35	17	15	T3	Fuel-pressure test: Ignition off. Connect pressure gauge to fuel-distributor. Ignition on. Press push-button T3.	20 to ground	2,8...3,2 bar



Injection signal
 t_i = Duration of injection

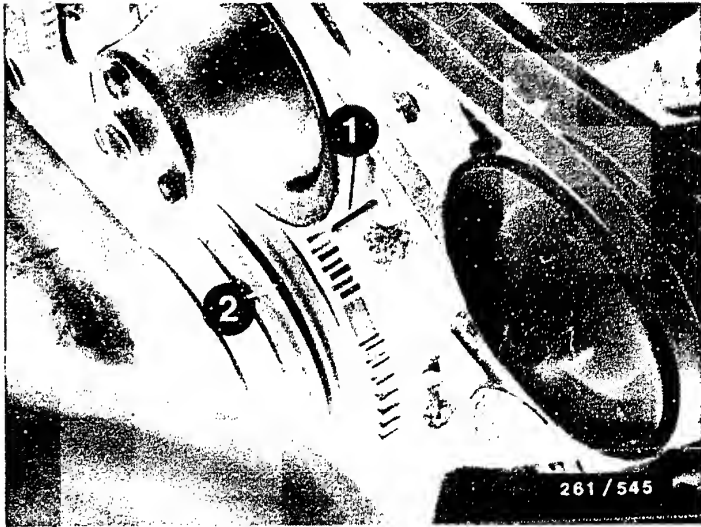
RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER (CONTINUED)

Test step	Switch position V Ω	Measurement and remarks	Measurement at control-unit plug between term.	Set values
36	17 15	<p>Test CO and idle speed: Connect motortester and CO analyzer.</p> <p>Carry out CO measurement first of all. Engine at norm. operating temperature, all consuming devices switched off. Turn CO pot clockwise: CO rises. Turn CO pot counterclockwise: CO drops. Note: CO max. at approx. 4.9 V CO min. at approx. 0.1 V</p> <hr/> <p>Note: idle speed cannot be adjusted (basic setting is also not applicable).</p> <p>If throttle-valve adjusted correctly (sealed at factory) and system otherwise O.K., the specified idle speed and on/off ratio result automatically.</p>	—	<p>0,4...1,0 % CO by vol.</p> <p>750...850 min. -1 (if deviation note test step 41)</p>
37	17 15	<p>Spark advance at idle speed. Run engine (at normal operating temperature) at idle speed (750...850 min. -1).</p> <p>Engine speed must be correct, otherwise incorrect spark advance is indicated. See lower illustration for ignition marking.</p>	—	5...15° crankshaft



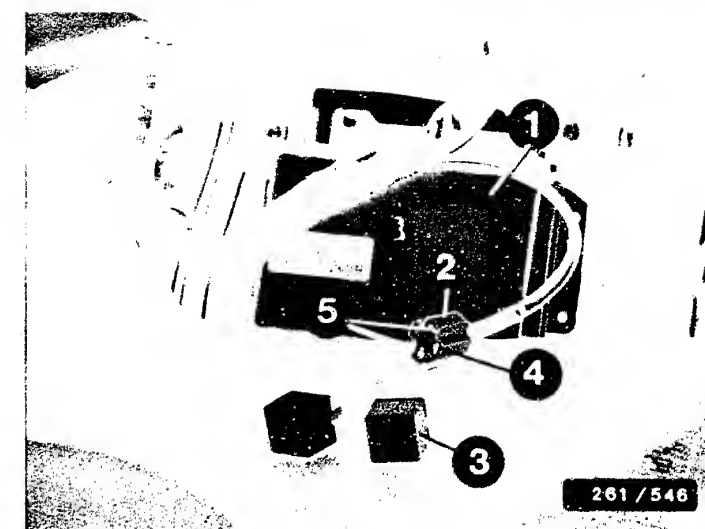
Arrow = CO adjusting screw

- 1 = Fixed gudgeon
- 2 = V-belt pulley with moveable ignition marking



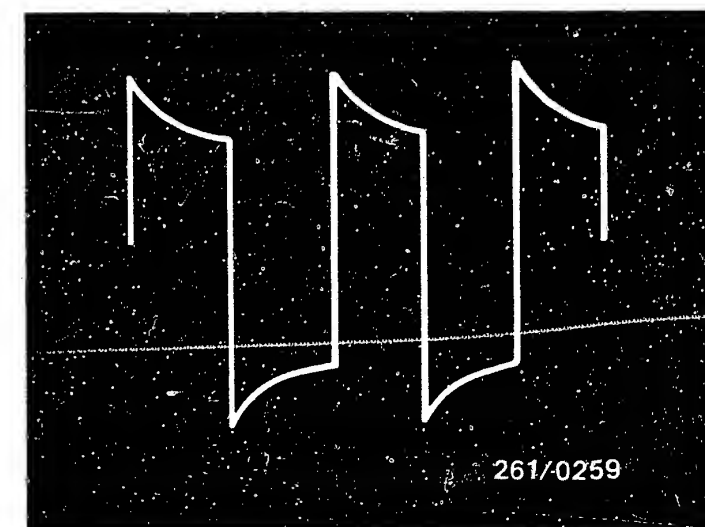
RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER (CONTINUED)

Test step	Switch position V	But- ton	Measurement and remarks	Measurement at control- unit plug between term.	Set values
38	17	15	T6 Spark advance at full load. Engine at normal operating temperature. Set engine speed to 3000 min ⁻¹ . Press push-button T6, and correct idle speed if necessary. Note (upper illustration) : Encoding component inserted = characteristic map for unleaded premium (min.95 RON) Without encoding component = charact. map for leaded premium (min.97 RON)	3 to ground	Term. 10 to ground: 6°...16° crankshaft at 3000 min. -1 Term. 10 open: 8°...18° crankshaft at 3000 min. -1
39	17	15	- Dwell angle at idle speed	—	8°...18°
			Dwell angle at 3000 min ⁻¹	—	30°...50°
40	17	15	T5 Overrun cut-off. Hold engine speed constant at approx. 3000 min ⁻¹ . Press pushbutton T5. Injection signals cut out and engine speed fluctuates rhythmically.	2 to ground	Engine "hunts"
41	18	15	- Signal at idle actuator (single-winding rotary actuator) with oscilloscope (special input). Run engine at idle.	33 and 5	Signal pattern, see lower illustration
42	19	15	- Not applicable	34 and 5	
43	20	15	- Camshaft actuation (relay 3). Voltage at term.31 Run engine at idle speed.	31 and 5	10...15 V
		T6	Adjust engine speed to approx. 4 min ⁻¹ and press push-button T6 (if necessary, increase idle speed if engine not running smoothly).		Max.3000 V



- 1 = Control unit
- 2 = Relay frame at wiring harness
- 3 = Encoding component (red housing)
- 4 = Connection to control unit term.10
- 5 = Ground connections

Signals at idle actuator



TEST SPECIFICATIONS

Pressure regulator	
Fuel pressure	2,8...3,2 bar
Electric fuel pump (measured in return)	Fuel delivery at least 750 cm ³ /30s
Supply voltage (under load):	at least 12 V

Intake-air temperature sensor
Internal electrical resistance
measured at air-flow sensor
between term.5 and term.4

at ambient temperature
(+15°C...+30°C): 1450...3300 Ω

Coolant-temperature sensor
(plug color, blue)
Internal electrical resistance

at + 15° C...+ 30° C : 1450...3300 Ω
with engine at norm. op. temp.
(approx. + 80° C): 280...360 Ω

Solenoid-operated injection valve

Internal electrical resistance
at ambient temperature
(+ 15° C...+ 30° C): 14,5...17 Ω

Air-flow sensor

Internal electrical resistance between:
term.2 and term.4 : 8...2500 Ω (*)
term.3 and term.4 : 300...550 Ω
term.1 and term.4 (CO potentiometer):

Minimum 0...30 Ω
Maximum: the actual value measured
between term. 3 and term. 4 may be
up to 30 Ohms less.

(*) Slowly deflect air-flow sensor flap as far as
it will go. Resistance fluctuates between the
terminals of the potentiometer.

TEST SPECIFICATIONS (CONTINUED)

Engine-speed sensor and reference-mark sensor.
Internal electrical resistance at
ambient temperature (+15°C...+30°C): 400...800 Ω

Air gap: 0,8±0,5 mm

Throttle-valve switch

Resistance value of idle
contact (term.2 and term.18): 0 Ω

Resistance value of full-load
contact (term.3 and term.18) 0 Ω

Idle actuator

Internal electrical resistance
at +15°...+30°C : approx. 8 Ω

Ignition coil

Primary resistance approx. 1 Ω
Secondary resistance 5000...7200 Ω

Idle speed: 750...850 min⁻¹

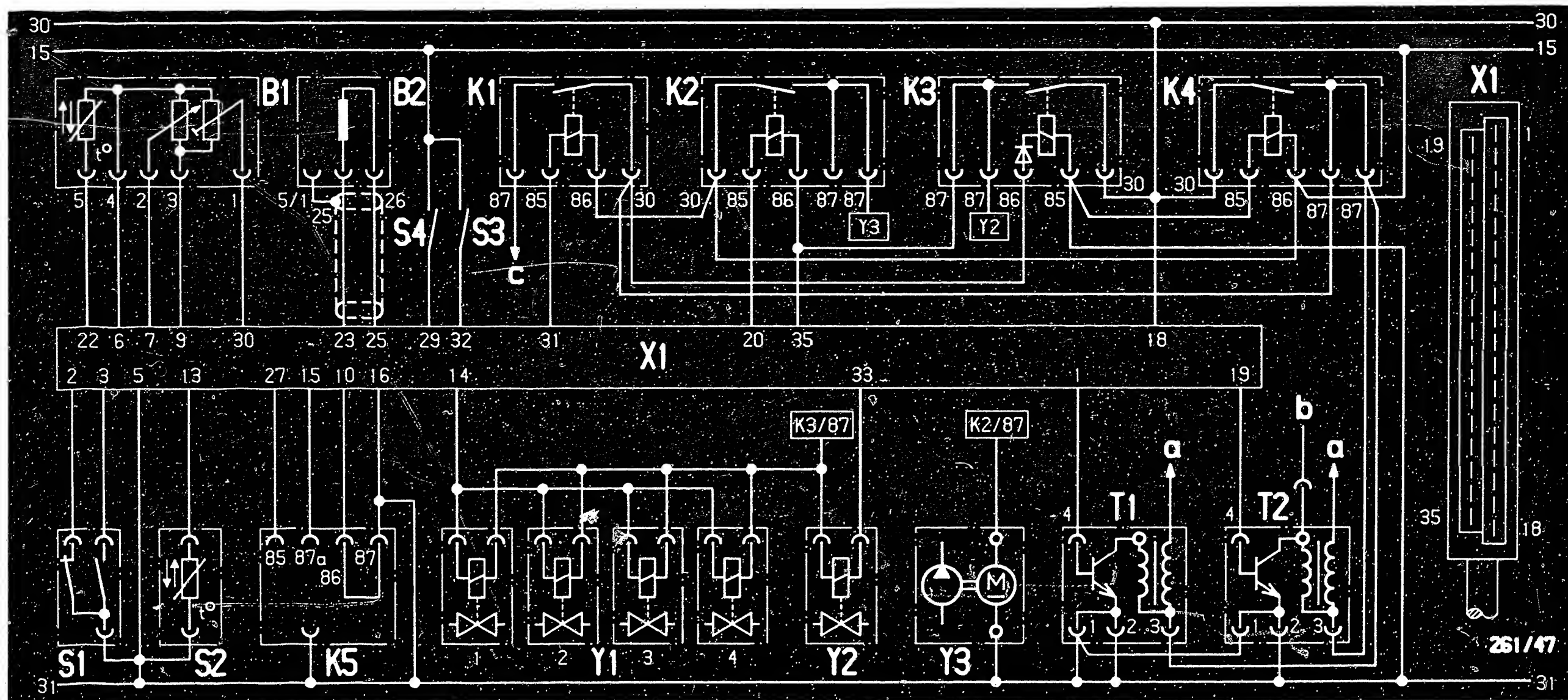
Spark advance: 10±5 ° crankshaft

CO content: % CO by vol.

Adjust mixture at CO potentiometer in
air-flow sensor:

turning counterclockwise makes mixture leaner,
turning clockwise makes mixture richer.
(Max. adjustment of duration of injection: 0.5 ms)

See equipment and Autodata microcards for
setting values for valve clearance and
other engine-related data.



X1 = Control-unit plug
(35-pin)

B1 = Air-flow sensor with CO pot.

B2 = Engine-speed/reference-mark sensor

K1 = Relay 3 (camshaft
activation)

K2 = Relay 1 (pump relay)

K3 = Relay 2 (main relay)

K4 = Relay 4

K5 = Encoding component (characteristic-
map selection) (mini-relay housing)

S1 = Throttle-valve switch

S2 = Coolant-temperature sensor

S3 = Air-conditioning compressor
switch (if fitted)

S4 = Air-conditioning readiness
switch (if fitted)

Y1 = Solenoid-operated injection valves

Y2 = Idle actuator (single-winding rot.
actuator)

Y3 = Fuel pump

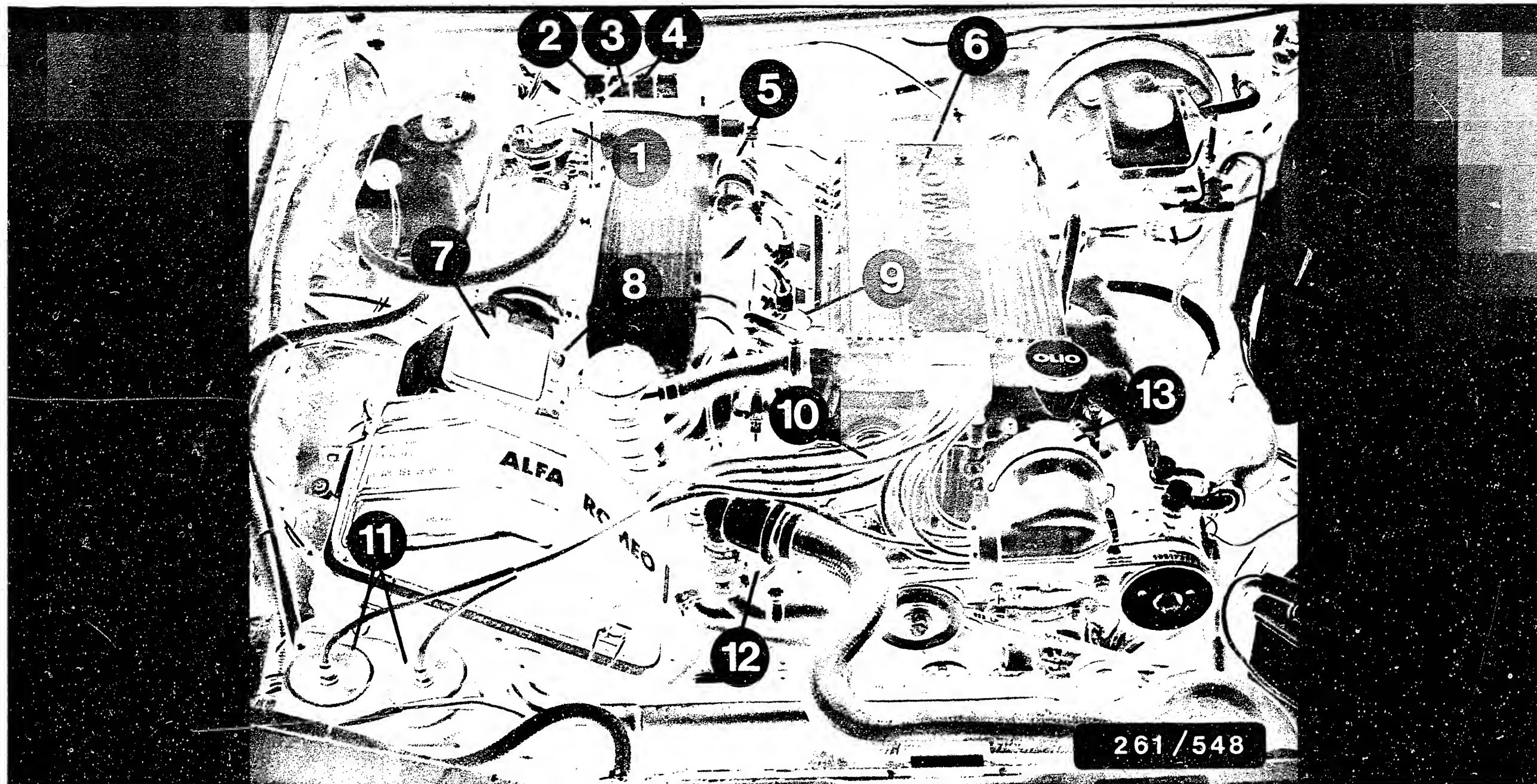
T1, T2 = Ignition coil/trigger box
assembly

a = To the high-voltage
distributors

b = To engine-speed sensor

c = To solenoid valve

ELECTRICAL TERMINAL DIAGRAM



- 1 = Accelerator cable
- 2 = Relay 3
(camshaft actuation)
- 3 = Relay 2 (main relay)
- 4 = Relay 1 (pump relay)
- 5 = Idle actuator (sin.-wind. rot. act.)

- 6 = Ground terminal
- 7 = Air-flow sensor
- 8 = CO adjusting screw
(pot)
- 9 = Solenoid-operated inj. vlv.

- 10 = Solenoid valve
for camshaft
actuation
- 11 = Ignition coils
- 12 = Ignition distrib. 1
- 13 = Ignition distrib. 2

INSTALLATION POSITION OF COMPONENTS

INSTALLATION POSITION OF COMPONENTS (1)

The indications "right" and "left" always refer to the forward direction of travel.

Control unit:

Behind the floor mat on the passenger's side
(upper illustration, Item 1).

Encoding connection:

5-pin relay frame at wiring harness near to control unit
(upper illustration, Item 2).

Engine-speed/reference-mark sensor:

On engine at front, to the left of the crankshaft ring gear
(see center illustration).

Temperature sensor I (air):

In air-flow sensor.

Temperature sensor II (engine):

On the suction side of the engine (blue plug).

Throttle-valve switch:

At bottom on throttle-valve assembly (see lower illustration).

Fuel pump and fuel filter:

Beneath the vehicle, near to fuel tank.

Pressure regulator:

On fuel-distribution pipe

Pressure damper:

In front of pressure regulator.

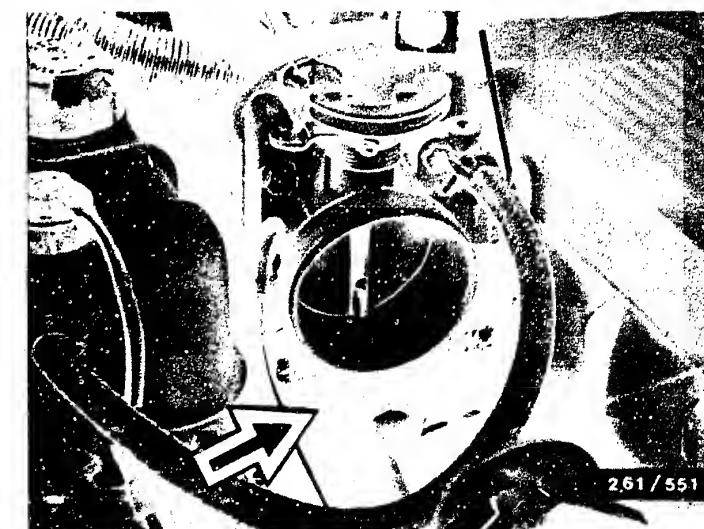
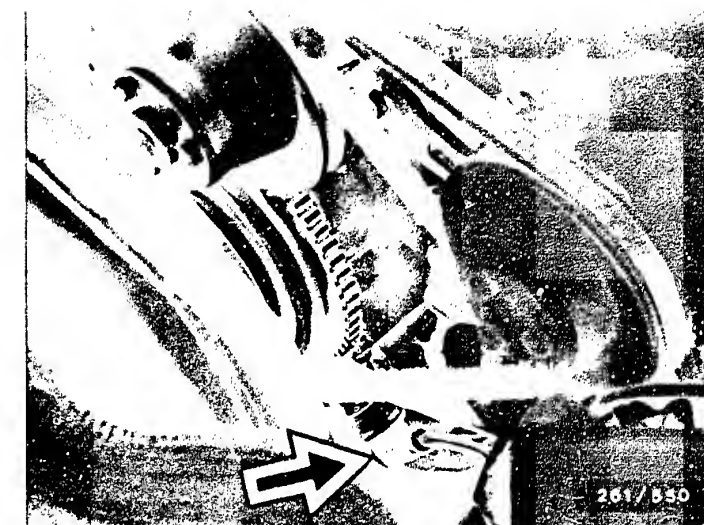
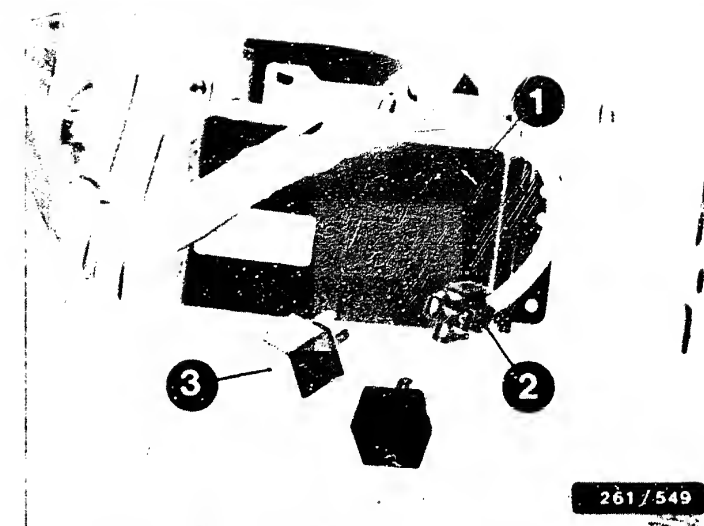


TABLE OF CONTENTS

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BOSCH system	:	EI
Make of vehicle	:	Alfa Romeo
Basic microcard	:	OPE-504

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SPECIAL FEATURES

These trouble-shooting instructions, valid at the time of publication, apply to the following Alfa Romeo model:

- * Alfa 75 6V 3.0 as of 4. 1987
- * Electronic ignition system (EI).
- * Spark-advance mechanism 0 227 921 035 and ..036
- * Temperature-dependent switch-over of characteristic ignition curves
- * Trigger box 0 227 100 111 with current limitation

The EI system installed in this vehicle corresponds essentially to the EI system used in the Opel Monza and Senator, with the following differences:

- * Activation of the L-Jetronic by primary signal from term. 1 of the ignition coil.
- * Terminal 7 of the spark-advance mechanism is connected only to a temperature switch.

STRUCTURE, USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to various causes/component faults.

For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to prevent damage to the engine, trigger boxes and control units or to the ignition system, be sure to observe the information in the basic instructions.

CAUTION!
High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

* Disconnect trigger-box plug when testing the compression or apply ignition coil term. 4 firmly to ground using an auxiliary cable.

Note:
Auxiliary cable must be interference-suppressed with at least 2 k Ω .

For further precautionary measures, see basic instructions.

TROUBLE-SHOOTING CHART

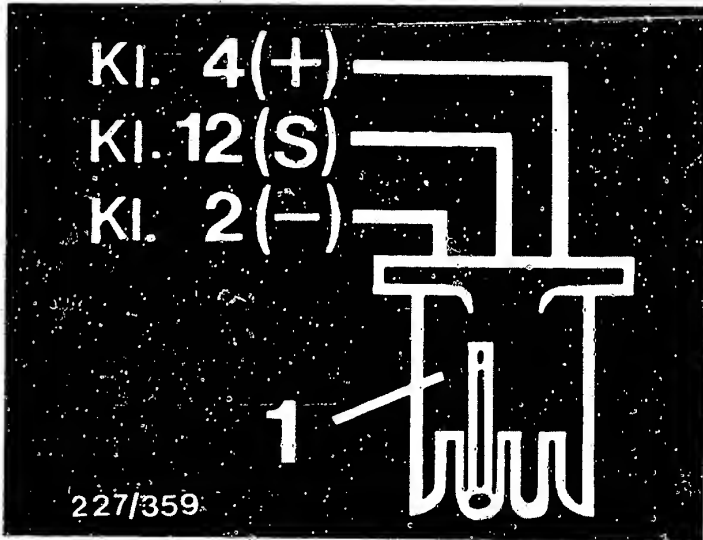
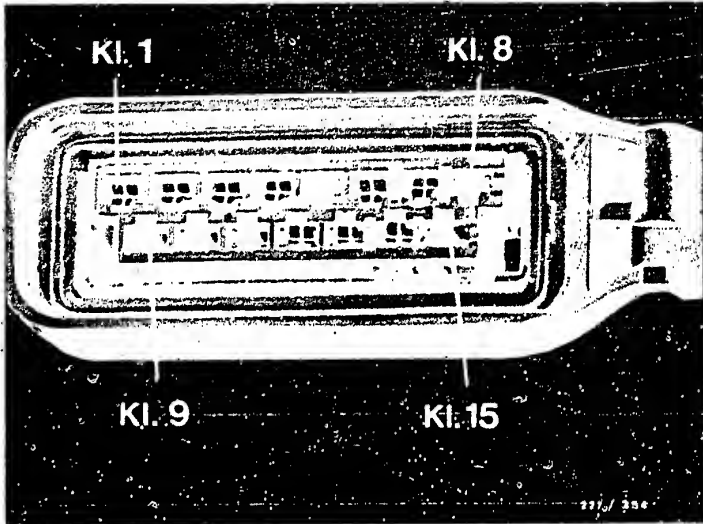
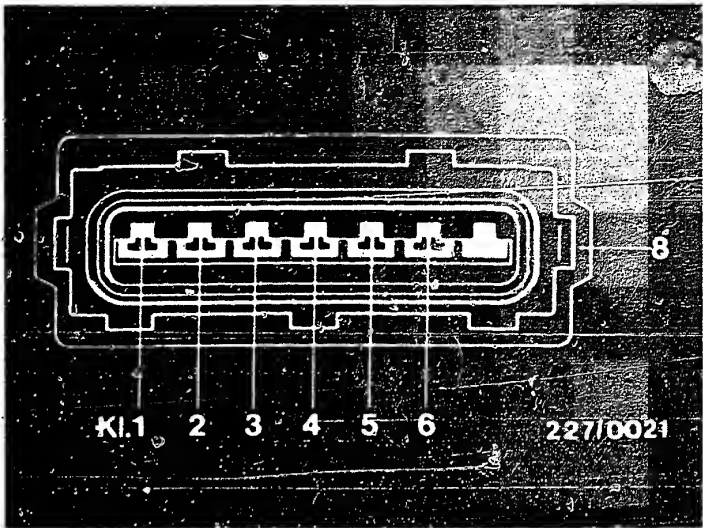
Customer complaint (symptoms of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Rough idling (engine speed, exhaust gas).
4. Poor throttle response, flat spot during acceleration.
5. Engine misfiring (ignition, fuel injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

Cause (component fault)										
*	*	*	*	*	*					High-voltage side
*	*	*	*	*						Ignition coil
*	*									Firing sequence
*										Voltage, trigger box
*										Voltage, primary circuit
*										Voltage, spark-advance mechanism
*		*	*							Voltage, magnetic pulse generator
*		*	*							Magnetic pulse generator, operation
*										Spark-advance mechanism operation
*										Ignition distributor
*										Contact resistances
	*	*	*	*	*	*	*	*	*	Throttle-valve switch, idle
	*	*	*	*	*	*	*	*	*	Throttle-valve switch, full load
	*	*	*	*	*	*	*	*	*	Basic ignition setting
			*							Voltage, spark-advance mechanism
			*							Voltage, trigger box
			*							Voltage, ignition coil
			*							Primary voltage

RAPID DIAGNOSIS CHART

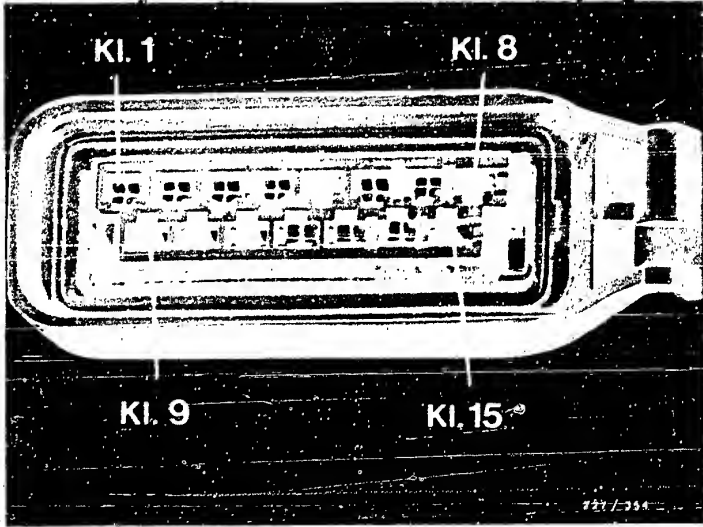
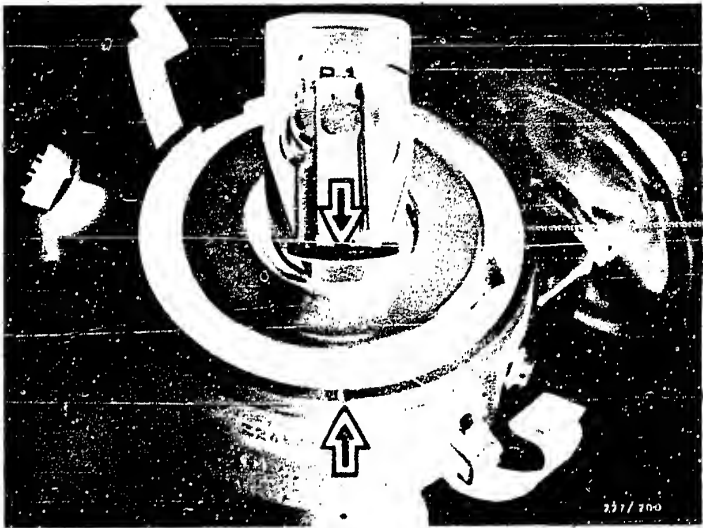
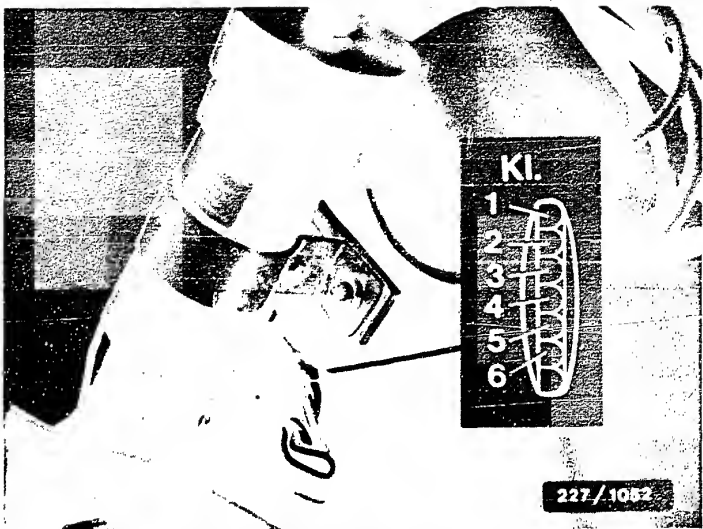
Test step	Testing of component/function Test conditions/instructions	Terminals	Set values
1	HIGH VOLTAGE SIDE, visual examination distributor cap, ignition harness etc.). Ignition oscillogram	—	—
2	IGNITION COIL, visual examination, plug present, sealing compound escaped? Resistance, primary Resistance, secondary	1 15 1 4	0,7...1,2 Ω 6,9...11,9 k Ω
3	VOLTAGE SUPPLY, TRIGGER BOX Ignition ON. Voltage, trigger-box plug	4 2 + —	approx. U _B
4	PRIMARY CIRCUIT Ignition ON. Voltage, trigger-box plug	1 2 + —	approx. U _B
5	VOLTAGE SUPPLY, SPARK-ADVANCE MECHANISM Ignition ON. Voltage, spark-advance mechanism plug	3 1 + —	approx. U _B
6	VOLTAGE SUPPLY, MAGNETIC PULSE GENERATOR Ignition ON. Voltage, ignition-distributor plug	4 2 + —	> 10 V
7	MAGNETIC PULSE GENERATOR, OPERATION Start engine. Measuring signal, ignition-distributor plug and vehicle ground.	12 8— + —	Rectangular pulse



RAPID DIAGNOSIS CHART (Continued)

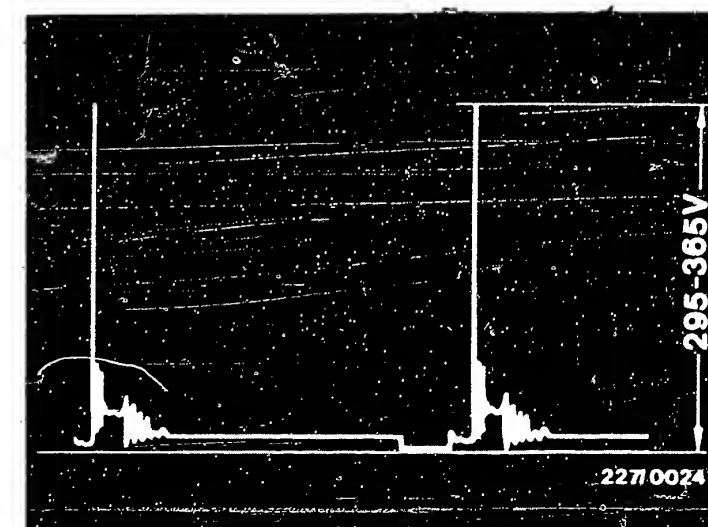
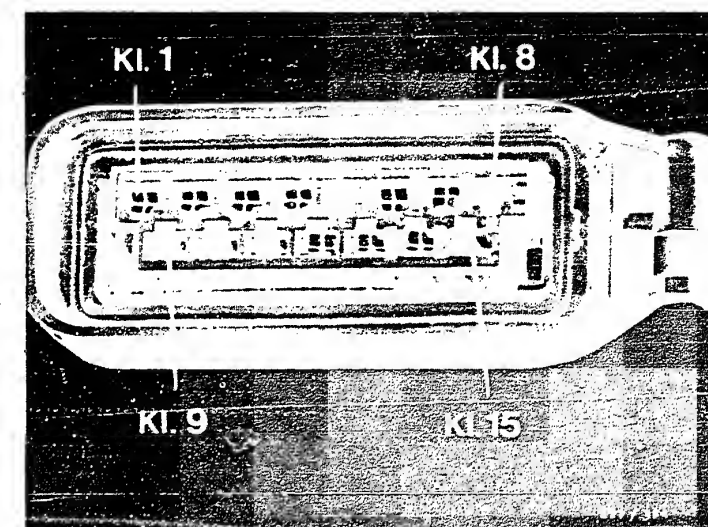
Test step	Testing of component/function Test conditions/instructions	Termi- nals	Set values
8	SPARK-ADVANCE MECHANISM Trigger-box, ignition-distributor and spark-advance mechanism plugs are connected. Start engine.. Measuring signal at trigger-box plug and vehicle ground.	5 B- + -	Rectangular pulse
9*	IGNITION-DISTRIBUTOR INSTALLATION ADJUSTMENT Engine cyl. 1 at TDC. Distributor rotor points to housing marking.	—	—
	CONTACT RESISTANCES Test voltage-supply lines of trigger box and primary circuit for contact resistance.		max. 0.3 Ω
10	THROTTLE-VALVE SWITCH, IDLE Disconnect L-Jetronic control-unit plug. Throttle valve in idle position. Resistance, spark-advance-mechanism plug	6 1	approx. 0 Ω
		6 1	infinity Ω
11	THROTTLE-VALVE SWITCH, FULL LOAD Disconnect L-Jetronic control-unit plug. Throttle valve fully opened. Resistance, spark-advance-mechanism plug Close throttle valve. Resistance, EI control-unit plug	14 1	approx. 0 Ω
		14 1	infinity Ω

* Perform only when the engine is not running.



RAPID DIAGNOSIS CHART (Continued)

Test step	Testing of component/function Test conditions/instructions	Terminals	Set values
12	COOLANT-TEMPERATURE SWITCH Resistance, spark-advance-mechanism plug with coolant temperature < approx. 35° C: with coolant temperature > approx. 40° C:	7 1	approx. 0 Ω infinity Ω
13	BASIC IGNITION SETTING Run engine (at normal operating temperature) at idle (700...900 min ⁻¹), disconnect vacuum hose from ignition distributor, connect short-circuiting device KDZS 0003 to throttle-valve-switch plug. Read off spark advance.	—	0 ° +/- 1° Marking "P" must align with pin
14	VOLTAGE SUPPLY, TRIGGER BOX Voltage, trigger-box plug with engine running at idle speed	4 2 + -	12...14 V, max. 1 V below U _B
15	VOLTAGE SUPPLY, IGNITION COIL Engine running at idle speed. Voltage, ignition coil and negative battery terminal	15 B- + -	> 10 V
16	PRIMARY VOLTAGE Voltage, ignition coil with engine at idle.	15 1 + -	295...365 V



TEST SPECIFICATIONS

Ignition coil, primary	0,7...1,2 Ω
secondary	6,9...11,9
k Ω	

Basic ignition setting	0 ° \pm 1°
at 700...900 min ⁻¹ (engine at norm. op. temp.)	

Coolant-temperature switch	< 35 ° C	approx.	0 Ω
	> 40 ° C	infinity	Ω

Voltage supply, magnetic pulse generator with ignition on	> 10 V
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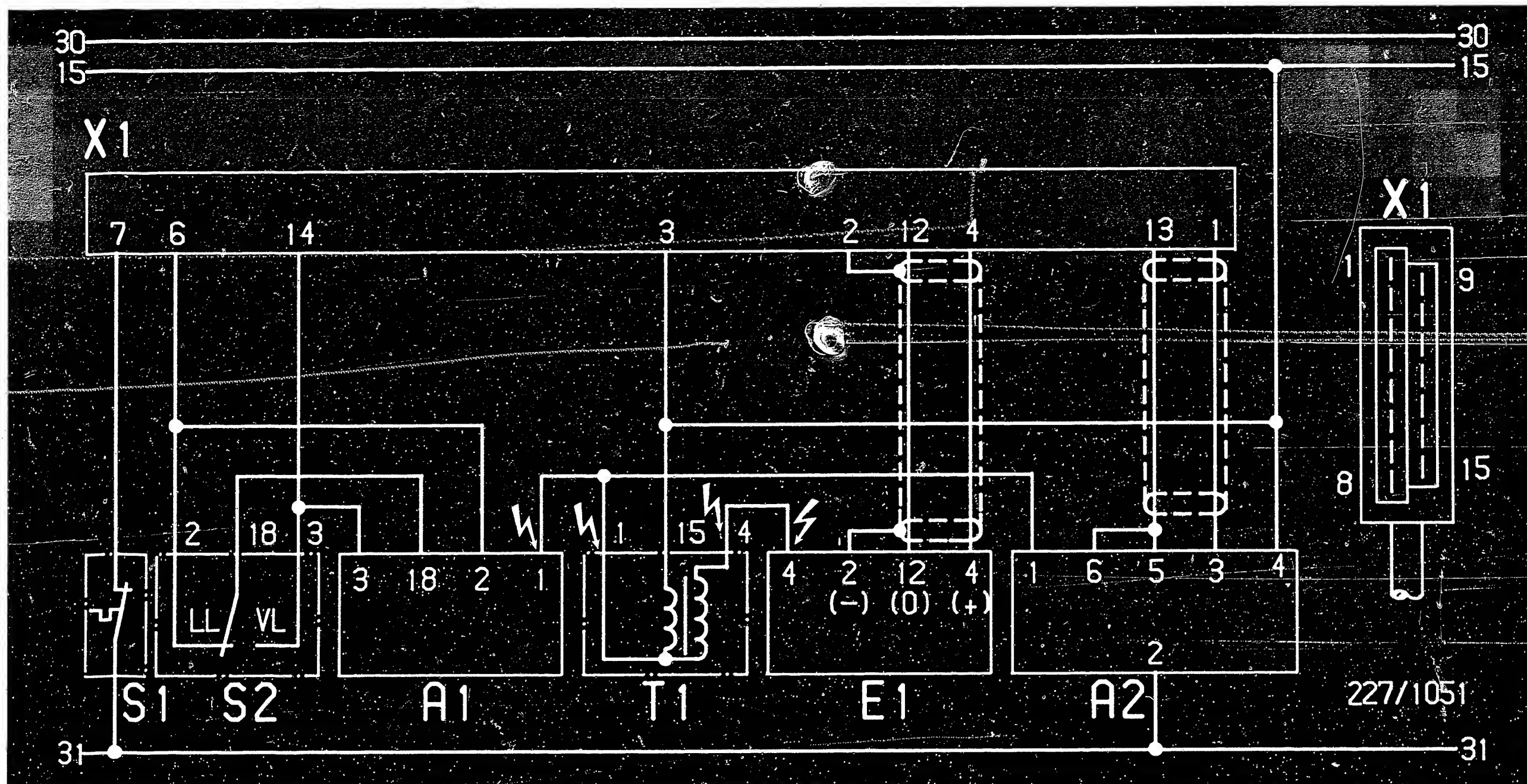
Voltage supply, trigger box with engine at idle	12...14 V
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Voltage supply, ignition coil with engine at idle	> 10 V
---	--------

Primary voltage with engine at idle	295...365 V
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For production reasons:
continued on the following
coordinate.

See Autodata test specifications for
the setting values for idle speed, exhaust
gas, valve clearance etc.



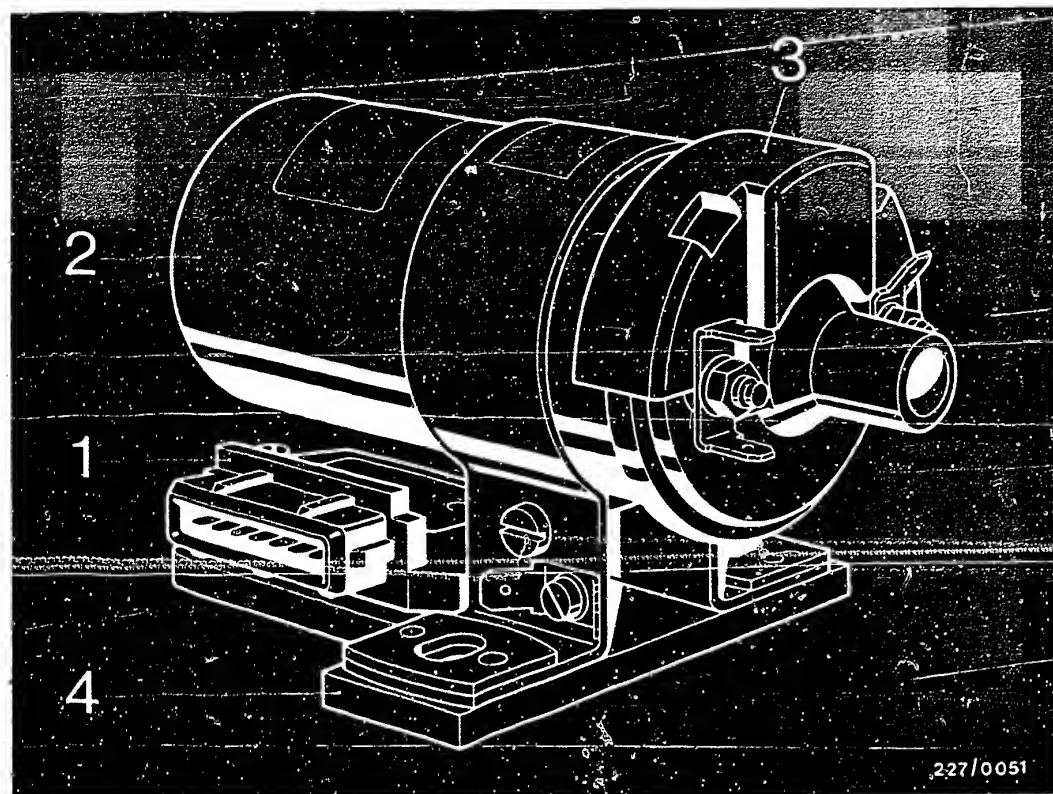
High-voltage symbol = dangerous voltages (400 V - 25 kV)

A1= Jetronic control unit
A2= Trigger box
E1= Ignition distributor

S1= Coolant-temperature switch
S2= Throttle-valve switch

T1 = Ignition coil
X1 = Spark-advance-mechanism plug

ELECTRICAL TERMINAL DIAGRAM



1 = TI-trigger box

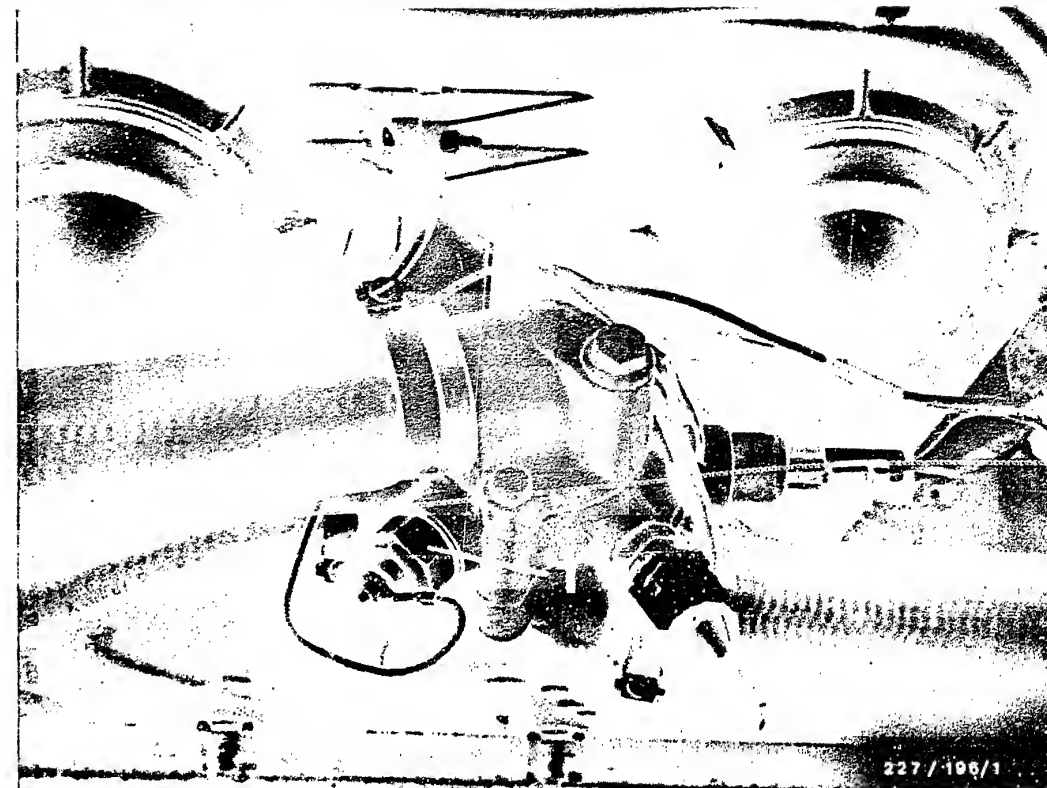
3 = Protective cap

2 = Ignition coil

4 = Heat sink

Installation position of components

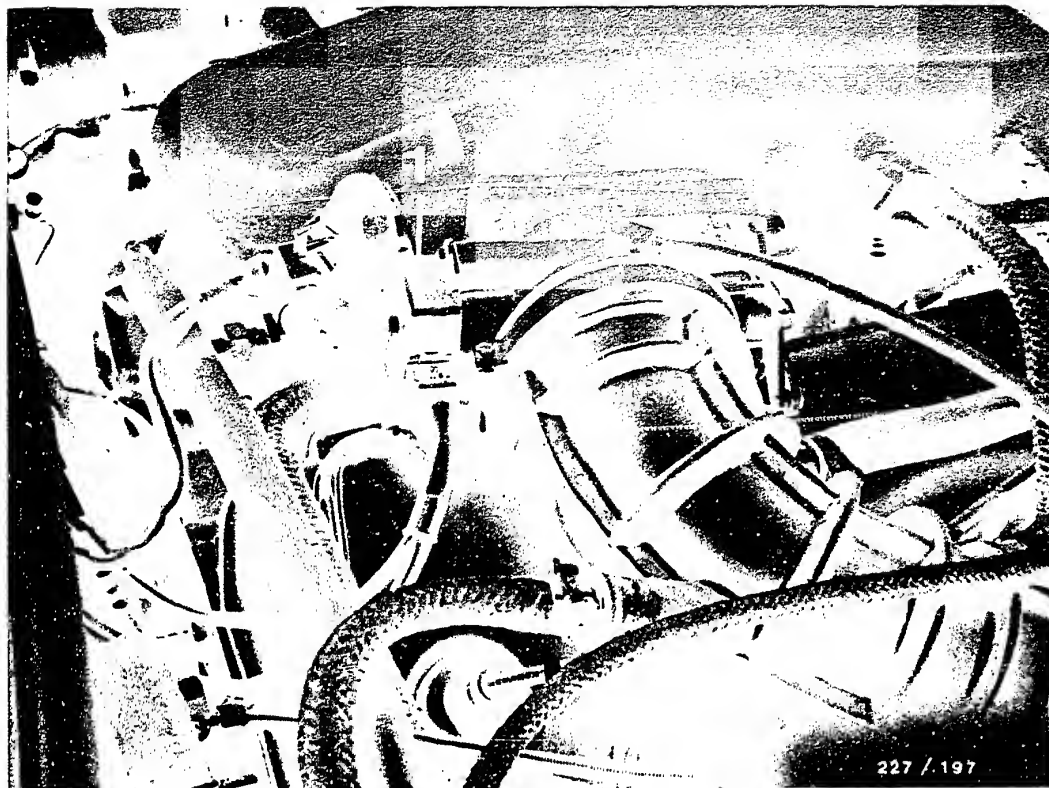
Trigger box and ignition coil are mounted on a common heat sink and accommodated in the eng. compart. on the left-hand side as seen from the forward direction of travel.



1 = Coolant-temperature switch

Installation position of components (continued)

The coolant-temperature switch is screwed into the thermostat housing at the front of the engine.



1 = Throttle-valve switch

Installation position of components (continued)

The throttle-valve switch is located on the throttle-valve assembly, on the right as seen from the forward direction of travel.

For production reasons:
continued on the following
coordinate.

Installation position of components (continued)

The spark-advance mechanism is located in the vehicle interior, on the passenger's side behind a covering; see upper illustration.

Note on removal:

Pull away covering in direction of arrow (is held by two spring clips).

For removing the EI control-unit plug, loosen fastening nuts (Item. 2, lower illustration) and remove EI control unit (Item 1, lower illustration).

